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Delays in Construction Projects: Analysis of Critical Risk Factors in Small Brazilian Companies

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Abstract:

The risks in the construction sector present complexity in the operational processes that usually affect the deadlines in the project schedules. Although risk management composes the structure of project management, its operationalization is not adopted by many companies in the sector, especially the smaller ones. This article aims to identify and prioritize the main risk factors that have an impact on the delays in the construction projects of the small construction companies in Basil. Based on the literature, 43 risk factors associated with the construction environment were identified, however, after the application of a preliminary questionnaire, only 26 factors were directly related to delays in the projects of small construction companies. A survey was applied to 133 professionals working in small builders. After verifying the content validity and consistency of the instrument, the data obtained were a normal distribution. Through exploratory factor analysis, six critical risk factors were identified and hierarchized, according to their levels of relevance for professionals in the sector. The results presented aim to contribute to the effectiveness of the risk management processes, to minimize the factors that potentiate the risk of delay in small projects in the construction sector.

Keywords **—Construction projects, Factor analysis, Project delays, Risk factors.**

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I. INTRODUCTION

Delays are natural and recurring phenomena in construction projects and are caused by several factors internal or external to the construction environment. They can directly affect in two ways: a. Compromising the sequence of the internal stages of the construction processes, reflecting in the flow of the operations of the other involved areas, besides the scheduling of service of the suppliers; B. impacting the delivery of the product to the customer, which may result in fines or damages to the company's image in the market.

Although it is a common problem in several countries, the magnitude of the impacts generated by delays can vary according to the characteristics of each project (Sweis, 2013) [1].Given this understanding, actions that proactively identify, evaluate and mitigate proactively any factors that may compromise the results of construction project schedules (Wong and Vimonsatit, 2012) are required [2].

It is essential to highlight that during the planning phase of a project, two aspects are contemplated:

1. the generation of cash flows to meet the needs of internal stages;

2. analysis of economic and financial availability, which do not include qualitative impacts that risks may represent in the initial stages of the processes.

In the execution and monitoring phases, also understood as the operational aspect of the construction processes, it is necessary to develop a

culture of proactive actions that anticipate the appearance of factors harmful to the operational processes.

In general, companies in the construction sector have a strong resistance to the adoption of risk management processes in their projects. In the case of small companies, several factors collaborate so that they choose to conduct their operations according to the traditional flow of other companies. These factors are often associated with a general understanding that project planning already addresses all risks, leaving aside the operational part that represents the execution and delivery of the products. In this sense, a specific approach, which identifies the main risk factors that affect the production processes defined by the projects, allowing the response actions to be carried out in a shorter time, at a lower cost, may represent an increase in the effectiveness of the processes, with satisfactory results for both parties, client and builder.

Through a quantitative approach, generated from a Survey-type survey applied to professionals and specialists working in small companies in the Brazilian civil construction sector, we sought to identify and prioritize the main factors that affect the effectiveness of deadlines defined by construction projects. Through a statistical approach, we tried to answer the following questions:

Q1: What are the main operational risk factors affecting the schedules of the small construction projects of the national construction industry?

Q2: What is the order of relevance of the main risk factors that impact the delays of small companies in the national construction sector?

In summary, the approach of risk factors in construction sector projects is based on the objective of identifying hierarchical factors according to their levels of occurrence, so that the monitoring and control processes are continuous, providing efficiency in meeting deadlines. Thus, this research aims to assist Brazilian small-scale construction companies and direct focus and efforts on specific actions to achieve their goalswithout compromising their costs.

II. LITERATURE REVIEW

A. Size of construction companies

The size and size of a company are defined, according to the Brazilian Micro and Small Business Service - SEBRAE (2014), second paragraph: billing and staffing. This search is such that they are given to the billing date. Thus, aiming to understand a size variable on each side, through the Brazilian Chamber of Construction Industries (CBIC, 2018), the aim was to identify the percentages of companies and labour quantitative participation, according to the Table 1 [3],[4].

TABLE 1
CLASSIFICATION OF THE COMPANY SIZE FOR THE NUMBER OF EMPLOYEES

Size	Employee Board	Market share in 2017	
		Amount(%)	Labor (%)
Little	***to - 99***	***98,61%***	***58,55%***
Average	*100 - 499*	*1,23%*	*24,43%*
Great	*above - 500*	*0,16%*	*17,02%*

The results presented in Table 1 show the relevance of small construction companies in the national construction scenario, since they represent 98.61% of the total companies and 58.55% of the total stock of the active labor force in the sector.

B. Risk of delays in the construction sector

The literature presents several approaches, with several concepts associated with the term risk. In this sense, many similarities are verified about the authors' perception of this phenomenon, especially when they are related to damages of any nature.

Klüppelberg et al. (2014) associate the term risk with the complexity of factors that require the managers' multidisciplinary abilities to conduct prevention and correction actions [5]. Converging to this understanding, Garvey (2015) links the presence of risk factors to numerous possibilities, positive or negative, potentialized by the extent of the degree of uncertainties present in the processes [6]. Already Bissacolt and Oliveira (2016) condition the implementation of a risk management

to preserve stability in the internal and external environments of organizations [7].

Although many research highlights the difficulties of companies in the construction sector to meet the deadlines defined in their projects, there is still a need for a dedicated approach specifically to identify and standardize the main factors that impact the schedules elaborated for the conduct of internal processes and for the definitive closure of the projects, thus making the product available to customers. It is also perceived that this issue is potentialized in countries with economies in development, because the coverage of unwanted factors makes difficult the elaboration of a reference that allows companies to take effective actions to reduce their delays in projects, which directly reflect the survival in the market (Alsehaimi et al., 2013) [8].

Most of the risk factors associated with the delays in the process stages schedules are due to inconsistencies in the preliminary phases of project planning that, in order to meet inconsistent contract deadlines, underestimate the stages of construction processes. In this sense, the need to balance the time constraints in essential steps, results in damages to the natural flow of the following stages, generating changes and impacts in the scheduling of internal and external processes of organizations. This imbalance has a direct impact on the productive chains and the prediction of the availability of financial resources, generating an increase in the probability of uncertainties in order to follow the steps defined by the projects (Maués, 2017; Silva, 2012) [9], [10].

The PMBOK (2017) associates the presence of factors that cause delays in construction projects to a set of elements developed in the planning, execution and monitoring / control phases [11]. In addition, it proposes the implementation of a risk approach aimed at identifying, analysing and classifying the different risk factors, thus generating subsidies that enable preventive actions. In this context, the relevance of identifying and prioritizing the factors that characterize higher degrees of risk to the processes sequenced by the steps defined in the projects is highlighted (Zavadskas, 2010; Zou, 2007; Chapman, 2001) [12], [13],[14].

Although risk management presents tools that aim to ensure control and immediate response to the emergence of unwanted factors, its implementation is still understood by most construction companies as a matter that raises costs and compromises financial results, especially in small businesses that need to reduce their profit margins to ensure market competitiveness.

Sarmad et al. (2003) point out that the search for concepts and information on a given topic is essential for the researcher to have a theoretical basis for elaborating arguments and adopting appropriate analysis processes to support the results of his research [15]. In this sense, this research begins with the theoretical basis, through a qualitative approach, obtained by literature reviews, to verify aspects that cause the delays of the construction projects.

The literature review enables the researcher to identify, describe and interpret data from previous research to substantiate the structure of his work (Khaki, 1999) [16].

Through research on scientific bases, national and international surveys were identified that deal with themes related to risk, its factors and its management in construction. Table 2 shows the criteria used to search the scientific databases.

TABLE 2
CHARACTERISTICS OF THE RESEARCH FOR LITERATURE REVIEW.

Data Base	Keywords
ASCE	*Risks management;* *Risk factors in construction;* *Risks in constructionprojects;* *Risksofdelay;* *Delays in construction;* *Delays in projects.*
Emerald	
Google Scholar	
Science Direct	
Web of Science	

The research results point to 43 risk factors related to the construction environment that generate, directly or indirectly, impacts on project schedules. The identified factors were classified into nine categories of risk, as highlighted in Table 3.

TABLE 3
RISK CATEGORIES ASSOCIATED WITH THE PRODUCTIVE ENVIRONMENT OF THE CONSTRUCTION SECTOR.

CATEGORY	RISK FACTORS	AUTHORS
Politics	Politicalinstability	Ahmed et al. (2002); Arantes et al. (2015); Bing andTiong (1999) [16]; Bu-Qammaz et al. (2009) [17]; Chang (2002) [18]; Couto (2009) [19]; Couto and Teixeira (2007) [20]; Ellis and Thomas (2002) [21]; Fallahnejad (2013) [22]; Fang et al. (2004) [23]; Gad et al. (2011) [24]; HastakandShaked (2000) [25]; Liu et al. (2016) [26]; McCord et al. (2015) [27]; Moura et al. (2007) [28]; NgandSkitmore (2002) [29]; OlawaleandSun (2010) [30]; Shebob et al. (2012) [31]; Sullivan e Harris (1986) [32]; Tafazzoli (2017) [33]; Hwang et al. (2016) [34].
	Lackofgovernment incentives	
	Fragmentedpoliticalstructure	
	Elections	
Laws	Amendmentstolegislation	
	Excessivered tape	
	Complexityofthe Legal System	
Economics	Interestfluctuationandinflation	
	Instabilityoftheeconomy	
	Currencyvaluefluctuation	
Financial	Taxes	
	Difficulty in accessinginsurance	
	Difficulty in accessingcredit	
	Corruption	
	Reduced financial capacityofthecontractor	
	Reduced financial capacityofthecontractor	
	Reduced financial capacityofsubcontractors	
Social	Interpersonalconflicts (wars, disorder, revolts, etc.)	
	Intrapersonalconflicts (mentality, education, civics, communication, culture, etc.)	
Market	High competition	
	Reducedcapacity for technologicalinnovation	
	Decreasedqualityofbuildingmaterials	
	Reducedqualityand high labor cost	
	Lowqualityconstructionequipment	
	Unavailabilityofsubcontractors	
Environmental	Adverse weatherconditions	
	Unforeseensoilconditions	
	Floodsandfloods	
	Fires	
	Earthquakesandearthquakes	
Contractual	Typeofcontractandreduced "Base Price"	
	Reduced time limit	
Technical	Little experienceofthe design team	
	Deficienciesand / orfailuresof communication betweentheparties (designers-contractors, designers, contractor-contractor)	
	Delays in projectapprovalandregulation	
	Project Errors	
	Successivechangestoprojects	
	IncompleteInformation	
	Weaknesses in information for thepreparationoftheproposal	
	High projectcomplexity	
	Little experience in similar projects	
	Claimsatcritical points in theimplementationphase	
	Successiverestorationorreformworks	

The Table 3 shows the authors who take advantage of their projects, according to the perception that the types of investments generate delays in the construction projects of the countries, highlighting as political, legal, economic, social, market, environmental, contractual and technician.In smaller cases, factors related to lack of team leadership, customer relationship difficulties and communication providers between teams and stakeholders were characterized as managerial (Freitas, 2018, Muianga et al., 2015, Rosenfelde, 2014), but understanding the needs of detailing and anamnesis of category, aiming to obtain each one of its objectives [35], [36], [37].

III. METHODOLOGY

This research was carried out in the period between March and November 2018, aiming to identify the maximum risk factors that affect the timing of the projects of the small Brazilian construction companies and, through an exploratory approach, define the level of relevance for mitigating actions can be more effective.

The first phase of the research is characterised by the definition of the general reference, through bibliographical analysis of recent literature topics that address corporate risks associated with construction projects.

The second phase aims to define the requirements and the development of the methodology, through the characterisation of the samples, the elaboration of the research instruments and the preliminary analysis of the experimental data.

In the third and fourth phases, developed within the methodology, a definitive questionnaire is elaborated and presented to professionals who work in small Brazilian construction companies. The data obtained are analysed by a multivariate statistical approach, where the levels of content consistency

and reliability of the instrument are verified to guarantee the application of the exploratory factorial analysis (EFA).

The fifth phase of the research presents the analysis of the results.

A. Sample definition and profile of respondents

Guimarães (2008) defines as sampling, a set of individuals from a population with specific characteristics [38]. Sampling can be: probabilistic when the elements of the population have the same possibility of being chosen; or non-probabilistic, where the characteristics and information define the elements of the population needs that they can provide.

This research adopted a non-probabilistic sampling, characterized by 133 professionals with experience in small construction companies operating in the Brazilian market, according to the characteristics presented in Table 4.

TABLE 4
CHARACTERISTICS OF RESPONDENTS

Companies - Country Regions		
Southeast	*68*	*51,13%*
South	*26*	*19,55%*
Midwest	*18*	*13,53%*
Northeast	*13*	*9,77%*
North	*8*	*6,02%*
Professionals - Education		
Civil Engineering	*62*	*46,62%*
Architecture	*37*	*27,82%*
OtherEngineering	*26*	*19,55%*
Others	*8*	*6,02%*
Professionals - Experience in construction		
Above 10 years	*71*	*53,38%*
From 5 to 10 years	*54*	*40,60%*
lessthan 5 years	*8*	*6,02%*

From the definition of the sample size, the standards were identified for the analysis of the variables that, according to Hair et al. (2011), should be considered according to the sample size. As this study uses a sample with 133 respondents, it was considered 0.50 the minimum value for the load factors of the variables [39].

B. Elaboration of questionnaires and data collection

Martins and Theóphilo (2009) suggest that the processes of analysis of variables begin with the data collection, resulting from the questionnaires[40]. The structure of the questionnaires will depend on the approach adopted by the research, being it quantitative or qualitative. Where the results of the qualitative approaches may be appropriate to form a new questionnaire designed for a quantitative application. The application of these procedures allows statistical tools to be used in data evaluation (Maia; Iarozinski; Neto, 2016) [41].

The research instrument was based on two distinct stages that had the following aspects:

Phase 1 - preparation and application of an open questionnaire structured by guidelines, which was sent to a defined sample. The objective of this initial questionnaire was to verify, among the risk factors designated by the literature review, which presented a direct relationship with delays in project schedules.

The questionnaire was applied to a group of 16 professionals with extensive experience in companies in the construction sector and with consistent performance in micro and small size companies.

The results pointed out that 26 risk factors (variables), among the 43 identified in the literature, have characteristics related to delays in construction projects.

Interviews using guidelines present some degree of structuring and are structured according to the researcher's interest. This procedure seeks to stimulate the interviewees to discuss their perceptions related to the theme freely and is usually associated with qualitative approaches (Britto, 2011; Guimarães, 2008) [42], [38].

Phase 2 - elaboration and application of a survey type survey, through a structured questionnaire, composed of the 26 variables identified in phase 1.

The questionnaire used in this phase was formed by questions measured using the Likert scale.

The use of scalar analysis, according to Gil (1999) [43], confers simplicity to the instruments and objectivity to the answers. Thus, the variables were

measured based on semantic scales, where the respondents identified the indices that represented their opinions, as described in Table 5.

TABLE 5
STAGGERED EVALUATION OF VARIABLES

It does notoccur	Raretooccur	Unlikely	Possibletooccur	Very likely	Always occurs
0	*1*	*2*	*3*	*4*	*5*

In the scale used, the answers varied from 0 (zero) to 5 (five), making a total of six points, where the lowest value indicated the lack of the degree of perception of the respondents. This phase aimed to obtain data for the application of statistical procedures. Table 6 describes the variables identified by step 1 that were addressed by the research instrument in phase 2.

TABLE 6
VARIABLES IDENTIFIED FROM THE APPLICATION OF THE FIRST QUESTIONNAIRE

Variables	Risk factors
V1	ChangestoLegislation
V2	High bureaucracy
V3	FluctuationofInflationandtheInterest Rate
V4	Taxes
V5	Corruption
V6	Reduced Financial CapacityoftheOwnerofWork
V7	Interpersonalconflicts (wars, disorder, revolts)
V8	Intrapersonalconflicts (mentality, education, communication, culture, religion)
V9	WeaknessandLackof Communication BetweenParties
V10	High labourcost
V11	ReducedCapacity for TechnologicalInnovation
V12	DiminishedQualityofConstructionMaterials
V13	Compressed Financial CapacityofSubcontractors
V14	Reducedqualityoftheworkforce
V15	Low-qualityconstructionequipment
V16	IndemnityofSubcontractors
V17	Adverse Climate
V18	Difficulty in accesstoinsurance
V19	Earthquakes
V20	Project Errors
V21	Little teamexperience
V22	ReducedTerm
V23	Successivechanges in projects
V24	Little experience in similar projects
V25	Incompleteprojectinformation
V26	High Complexityofthe Project

After the final tabulation of the data obtained by the questionnaire, the research followed the preliminary exploratory analysis of the data.

IV. RESULTS

A. Preliminary data analysis

Montgomery (2003) emphasises that any statistical procedure must begin by verifying the distribution and validity of the data. In this sense, the data were tested, and the presence of the normal distribution was confirmed in all the present variables, resulting in the rejection of the null hypothesis (H_0: The data do not present a normal distribution) [44].

From the normality check, the basic premise for multivariate factorial analysis, the number of correct answers and their respective percentages of representativity were analysed.

Hayes (1992) relates the statistical validity to the degree of consistency evidence [45]. For the author, the internal consistency should be considered as a measure of the reliability of the questionnaire, because it indicates the degree of difference that the items measure the same concept. In this case, its validity is usually considered from the validations of content and construct (Nunnally, 1967) [46].

Using the results of the Kaiser-Meyer-Olklin test (Hayes, 1992), the Cronbach's alpha coefficient (Streiner, 2003) and the Bartlett sphericity test (Field, 2013) were checked, respectively, for content reliability and objectivity of the research instrument, according to the results presented in Table 7 [45], [47], [48].

TABLE 7
SYNTHESIS OF PRELIMINARY TESTS

Numberofvalid responses		**133**
Numberofitems - questions		**26**
Cronbach's Alpha coefficient		0,917
Kaiser-Meyer-Olkinmeasureofsamplingsuitability		0,868
Bartlettsphericitytest	*Chi-square*	1985,421
	df	325
	Sig.	0,000

According to the data presented in Table 7, Cronbach's alpha exceeded the minimum acceptable value of 0.70, characterising a high internal

consistency in the evaluation scale (Streiner, 2003) [47]. The Kaiser-Meyer-Olkin test was used to verify the suitability of the sample and presented a satisfactory result, exceeding the minimum value of 0.60 (Hayes, 1992) [45]. The Bartlett sphericity test, which verifies the null hypothesis that the variables are not correlated, was considered valid because it presented a level of statistical significance lower than 0.05 (Field, 2013) [48].

B. Application of exploratory factorial analysis

The factor analysis adopted by this research has an exploratory character and sequence of actions can be understood from the synthesis of the stages presented in Table 8.

TABLE 8
SYNTHESIS OF THE STEPS OF APPLYING THE FACTOR ANALYSIS.

Stage	Process		Total Variables	ExcludedVariables	Variables Retained
1	CA 1	1ª Community Analysis	26	1	25
2	CA 2	2ª Community Analysis	25	0	25
	FL 1	1ª AnalysisofFactorialLoads	25	5	20
3	CA 3	3ª Community Analysis	20	1	19
4	CA 4	4ª Community Analysis	19	0	19
	FL 2	2ª AnalysisofFactorialLoads	19	6	13
5	CA 5	5ª Community Analysis	13	1	12
6	CA 6	6ª Community Analysis	12	2	10
7	CA 7	7ª Community Analysis	10	0	10
	FL 3	3ª AnalysisofFactorialLoads	10	0	10
	CM 1	1ª AnalysisofCorrelation Matrix	10	4	6
8	CA 8	8ª Community Analysis	6	0	6
	FL 4	4ª AnalysisofFactorialLoads	6	0	6
	CM 2	2ª AnalysisofCorrelation Matrix	6	0	6

Tables 9 to 12 present the results obtained in each step of the application of the factorial analysis, according to their processes and their actions, followed according to the behaviour of the variables addressed.

TABLE 9
ANALYTICAL RESULT OF THE FIRST TWO STAGES OF THE APPLICATION OF FACTORIAL ANALYSIS.

	Stage 1	Stage 2						
Variables	**CA1**	**CA2**	**FL1**					
V1	*0,71*	*0,71*		*0,70*				*0,34*
V2	*0,57*	*0,68*				*0,79*		
V3	*0,75*	*0,78*						*0,85*
V4	*0,65*	*0,64*	***0,41***	***0,62***				
V5	*0,73*	*0,71*			*0,37*	*0,65*		
V6	*0,65*	*0,65*				***0,57***		***0,41***
V7	*0,66*	*0,65*	*0,62*	*0,30*				
V8	*0,62*	*0,62*		*0,63*		*0,34*		
V9	*0,60*	*0,61*			*0,72*			
V10	*0,68*	*0,68*			*0,74*			
V11	*0,54*	*0,54*	*0,32*	*0,62*				
V12	*0,76*	*0,75*					*0,84*	
V13	*0,68*	*0,67*	*0,35*	*0,39*			*0,60*	
V14	*0,70*	*0,71*			***0,53***	*0,33*	***0,55***	
V15	*0,74*	*0,74*		*0,75*				
V16	*0,62*	*0,62*	*0,34*	*0,55*			*0,38*	
V17	***0,39***							
V18	*0,71*	*0,71*	***0,41***	***0,53***	***0,49***			
V19	*0,69*	*0,67*	*0,38*	*0,56*	*0,33*			
V20	*0,72*	*0,72*	*0,74*					
V21	*0,66*	*0,67*	***0,41***		***0,62***			
V22	*0,77*	*0,76*	*0,81*					
V23	*0,76*	*0,77*	*0,83*					
V24	*0,70*	*0,70*	*0,72*	*0,34*				
V25	*0,81*	*0,81*	*0,83*					
V26	*0,73*	*0,73*	*0,78*					

TABLE 10
ANALYTICAL RESULT OF THE THIRD AND FOURTH STAGES OF THE APPLICATION OF FACTORIAL ANALYSIS

	Stage 3	Stage 4					
Variables	**CA3**	**CA4**	**FL2**				
V1	*0,71*	*0,69*	***0,44***				***0,69***
V2	*0,63*	*0,62*				*0,76*	
V3	*0,71*	*0,74*					*0,84*
V4	*Excluída*						
V5	*0,65*	*0,65*	*0,31*		-	*0,67*	
V6							
V7	*0,63*	*0,63*	*0,75*				
V8	***0,47***						
V9	*0,58*	*0,59*			*0,66*	*0,35*	
V10	*0,74*	*0,75*			*0,84*		
V11	*0,60*	*0,60*	***0,49***		***0,44***		***0,35***

V12	*0,74*	*0,75*		*0,79*			
V13	*0,68*	*0,68*	***0,41***	***0,67***			
V14							
V15	*0,76*	*0,74*	***0,46***	***0,47***		*-0,34*	***0,43***
V16	*0,61*	*0,63*	***0,45***	***0,57***			
V17							
V18							
V19	*0,68*	*0,69*	***0,56***		***0,48***	***-0,35***	
V20	*0,72*	*0,73*	*0,79*				
V21							
V22	*0,73*	*0,73*	*0,81*				
V23	*0,68*	*0,68*	*0,77*				
V24	*0,72*	*0,72*	*0,82*				
V25	*0,80*	*0,80*	*0,84*				
V26	*0,74*	*0,74*	*0,82*				

TABLE 11
ANALYTICAL RESULT OF THE FIFTH, SIXTH AND SEVENTH STAGES OF THE APPLICATION OF FACTORIAL ANALYSIS

	Stage 5	**Stage 6**	**Stage 7**				
Variables	**CA5**	**CA6**	**CA7**	**FL3**			**CM1**
V2	*0,62*	***0,44***					
V3	*0,94*	*0,93*	*0,96*			*0,98*	
V5	*0,58*	*0,64*	*0,72*		*0,79*		
V7	*0,64*	*0,55*	*0,55*	*0,74*			
V9	*0,71*	*0,51*	*0,70*		*0,81*		
V10	*0,67*	***0,46***					
V12	***0,43***						
V20	*0,72*	*0,72*	*0,71*	*0,79*			*0,79*
V22	*0,74*	*0,74*	*0,75*	*0,81*	*0,31*		*0,81*
V23	*0,77*	*0,73*	*0,75*	*0,85*			*0,85*
V24	*0,72*	*0,66*	*0,65*	*0,80*			*0,80*
V25	*0,82*	*0,81*	*0,81*	*0,87*			*0,87*
V26	*0,75*	*0,74*	*0,75*	*0,85*			*0,85*

TABLE 12
ANALYTICAL RESULT OF THE LAST STAGE OF THE APPLICATION OF FACTORIAL ANALYSIS

	Stage 8		
Variables	**CA8**	**FL4**	**CM2**
V2			
V3			
V5			
V7			
V9			
V10			
V12			
V20	*0,71*	*0,85*	***High Correlation***
V22	*0,75*	*0,87*	***High Correlation***
V23	*0,73*	*0,86*	***High Correlation***
V24	*0,64*	*0,80*	***High Correlation***
V25	*0,83*	*0,91*	***High Correlation***
V26	*0,75*	*0,86*	***High Correlation***

At the end of the factorial analysis, six variables presented a high correlation value. as shown in Table 13.

TABLE 13
CRITICAL VARIABLES IDENTIFIED BY THE EXPLORATORY FACTORIAL ANALYSIS

Variables		**Factor loadings**	
		1	***Ranking***
V20	Project Errors	*0,918*	*1°*
V22	ReducedTerm	*0,876*	*2°*
V24	Little experience in similar projects	*0,868*	*3°*
V26	High Complexityofthe Project	*0,861*	*4°*
V25	Incompleteprojectinformation	*0,853*	*5°*
V23	Successivechanges in projects	*0,800*	*6°*

The result of the factorial analysis presents six variables that are grouped in a single construct, corresponding to 73.46% of the total variance explained, as shown in Table 14.

TABLE 14
TOTAL VARIANCE EXPLAINED BY THE GROUPING OF THERESULTING VARIABLES.

Construct	Initialeigenvalues			Square loadextractionsummations		
	Total	% ofvariance	% cumulative	Total	% ofvariance	% cumulative
1	**4,408**	**73,463**	**73,463**	**4,408**	**73,463**	**73,463**

V. CONCLUSIONS

The results obtained by the application of the exploratory factorial analysis identified six variables, or risk factors, that presented high correlation in their data. In practice, this means that they were the highlights of the professionals who participated in the survey. Factorial loads were considered by the study to verify the importance ranking of each factor within the construct(Table 13).

The total final variance explained reached an excellent representative percentage, meaning that the six variables identified together represent 73.46% of the total weight contemplated by the study (Table 14).

Finally, the category of technical risks was identified as the one with the highest potential for impacts of delays in small construction projects in Brazil.

Based on the results obtained by this research, it is suggested that future studies that address the risk management in small-scale construction companies,

lead to the identification and analysis of "elements of risk" that increase the appearance of critical factors in the construction sector. In this way, effective mitigating actions can be defined that reduce occurrences of delays in the construction projects of small construction companies.

Another suggestion arises from the premise that the exploratory approaches offer for future confirmatory research, validate or suggest adaptations in the presented findings.

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