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Potential antecedents to the adoption of Business Analytics in accounting

Potenciais antecedentes da adoção de *Business Analytics* na contabilidade

Potenciales antecedentes de la adopción de *Business Analytics* en contabilidad

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Abstract
The objective of this research is to analyze which factors precede the intention to adopt Business Analytics (BA) in accounting, according to professionals working in the area. Mixed methods were applied with a sequential explanatory strategy operationalized through a survey and semi-structured interviews with accounting professionals. As data analysis techniques, we used PLS and content analysis. The research result showed several technological, organizational, environmental, and human factors that impact the intention to adopt BA, mostly based on the literature. However, new factors emerged, some specific to the accounting context. Moderating variables of the intention to adopt BA were evidenced. The research presents a list of factors that contribute to the adoption of BA and opens possibilities for the accounting community, managers, and technology providers to act in promoting the adoption of BA.
Keywords: business analytics; adoption; TOE; accounting; mixed methods

Resumo
O objetivo desta pesquisa é analisar quais fatores antecedem a intenção de adoção de *Business Analytics* (BA) na contabilidade, de acordo com profissionais atuantes na área. Aplicou-se métodos mistos com estratégia explanatória sequencial operacionalizada por meio de survey e por entrevistas semi-estruturadas, com profissionais de contabilidade. Como técnicas de análise de dados utilizou-se PLS e análise de conteúdo. O resultado da pesquisa apresentou diversos fatores tecnológicos, organizacionais, ambientais e humanos que impactam negativa ou positivamente na intenção para adotar BA, a maior parte com lastro na literatura, contudo surgiram fatores novos, alguns específicos do contexto contábil. Evidenciaram-se variáveis moderadoras da intenção de adoção de BA. A pesquisa apresenta uma lista de fatores que contribuem para direcionar a adoção de BA e abrir possibilidades para que a comunidade contábil, gestores e fornecedores de tecnologia atuem na promoção da adoção de BA.
Palavras-chave: *business analytics*; adoção; TOE; contabilidade; métodos mistos

Resumen
El objetivo de esta investigación es analizar qué factores preceden a la intención de adoptar Business Analytics (BA) en contabilidad, según los profesionales que trabajan en el área. Se aplicaron métodos

mixtos con una estrategia explicativa secuencial a través de una encuesta y entrevistas semiestructuradas con profesionales contables. Como técnicas de análisis de datos se utilizaron PLS y análisis de contenido. El resultado de la investigación mostró varios factores tecnológicos, organizacionales, ambientales y humanos que impactan negativa o positivamente la intención de adoptar BA, principalmente basados en la literatura, sin embargo surgieron nuevos factores, algunos específicos del contexto contable. Se evidenciaron variables moderadoras de la intención de adoptar BA según los profesionales entrevistados. La investigación presenta una lista de factores que contribuyen a orientar la adopción de BA y abren posibilidades para que la comunidad contable, los gerentes y los proveedores de tecnología actúen en la promoción de la adopción de BA.
Palabras clave: *business analytics*; adopción; TOE; contabilidad; métodos mixtos

1 Introduction

In a business environment driven by rapid technological change, organizations need to act quickly to remain competitive (Božič & Dimovski, 2019; Knudsen, 2020). In this business dynamic, success will depend on the ability to identify opportunities and threats and to take timely assertive decisions (Aydiner et al., 2019). Added to this are the challenges that arise from the growing volume of available data, resulting in a race to use it in favor of better business results (Camm, Bowers, & Davenport, 2020).

In this context, many organizations are increasingly investing in business analytics (BA) solutions and highlighting this investment as an important factor for their business growth and digital transformation (Global State of Enterprise Analytics - MicroStrategy, 2020). The term business analytics refers to the use of data, statistical analysis, or quantitative methods so as to provide managers with better information about their operations, enabling more assertive fact-based decisions (Davenport & Harris, 2017).

Rikhardsson and Yigitbasioglu (2018) point out an evident relationship between the use of business analytics and the accounting area, as both have a common mission that is to facilitate organizational decision making. In fact, there is research on the use of analytics in accounting and on how these initiatives generate benefits for this area. Among them, we can mention the research by Singh, Lai, Vejvar, & Cheng (2019), which aims to examine the application of data analytics techniques in auditing to better understand how these techniques can support auditors. Moreover, the study by Nielsen (2018) identifies, discusses, and provides suggestions on how the business analytics phenomenon can influence management accounting and accountants.

On the other hand, the report “The Future of Analytics in The Finance Function - Global Survey 2020” from The Modern Finance Forum of FSN (2020), answered by senior finance and accounting executives, shows that 86% of the functions in the area do not use BA to get value from the data. For Perkhofer et al. (2019), there is a gap between what experts and researchers indicate about the benefits of using business analytics for the accounting area and what is observed in practice.

Given the above, this research intends to answer the following question: What technological, organizational, and environmental factors motivate the adoption of business analytics in accounting? Based on the context and the problems presented, the general objective of this research is to analyze potential antecedents to the adoption of business analytics, according to accountants.

As a theoretical lens, we chose to use the Technology-Organization-Environment (TOE) model proposed by the authors Depietro, Wiarda, & Fleischer (1990) to study the adoption of new technologies in organizations based on factors from technological, organizational, and environmental contexts. Justifications include mainly the scope of the model, which incorporates organizational and environmental factors as well as technological factors. This choice corroborates with Holsapple, Lee-Post, & Pakath (2014), who argue that the adoption of BA also depends on organizational issues and is influenced by environmental aspects. Furthermore, the model is flexible, as it can be applied to any type and size of organization (Li et al., 2018). Finally, another important justification is that the TOE model fits both to innovations in the support processes and to the business processes of organizations (Lie et al., 2018). In this research, accounting can be both a business process (*e.g.*, in accounting offices and auditing firms) and a support process (*e.g.*, in manufacturing and commerce companies).

This study is important firstly because by identifying the elements that motivate the adoption of business analytics, it helps to highlight motivators for new organizations to adopt BA. Companies who adopted it already show improved productivity and efficiency, streamlined decision making, and improved financial performance (Mikalef et al., 2020; MicroStrategy, 2020). Another contribution is the focus on the vision that accountants have about the adoption of BA in their work area. This is because these professionals can act as protagonists in this data analysis process, as the primary objective of accounting concerns the provision of useful information for decision making (Coyne, Coyne, & Walker, 2018; Perkhofer et al., 2019).

In contrast, according to Nam, Lee, & Lee (2019), despite the growing interest and investments in the adoption of analytics practices, a significant number of companies have still not managed to implement BA. Therefore, these authors suggest that research be carried out on guidelines for adopting BA. There is a

need for studies that empirically explore the adoption of BA in accounting (Wadan & Teuteberg, 2019; Appelbaum et al., 2017; Rikhardsson & Yigitbasioglu, 2018). By identifying potential antecedents to the adoption of analytics in accounting, we expect to reduce the gap between what researchers and experts suggest and what happens in practice (Gepp, Linnenluecke, O'Neill, & Smith, 2018), and to encourage the adoption of BA in different areas of accounting. In order to support this study, the next section presents the theoretical framework of the research.

2 Business Analytics in the accounting context and its antecedents

The term Business Analytics (BA) was created to represent the main analytical component of Business Intelligence (BI). It can therefore be understood as the use of data, statistical analysis, and quantitative and mathematical methods so as to help managers obtain improved information about their operations and to make better fact-based decisions (Davenport & Harris, 2017). The authors Holsapple, Lee-Post, & Pakath (2014) proposed three dimensions for understanding the scope of BA, namely domain, orientation, and technique. Domain refers to traditional business disciplines such as marketing and finance. Orientation consists of the core of BA, divided into: descriptive, predictive, or prescriptive. Technique refers to the way in which an analytics task is performed, for example: whether it uses a qualitative, quantitative, or hybrid technique; structured or unstructured data; and what approach is being used (data mining, visualization, etc).

Nielsen (2018) highlights three types of analytics orientation, as there are different stages of use of analytics and each stage comprises questions that need answers. The first orientation is descriptive and aims to answer questions about what happened and its consequences. These answers take place through reports, *ad hoc* queries, and interactive views. This is the most commonly used type of analysis. It is also the basis of many continuous monitoring alert systems in which transactions are compared against benchmarks and thresholds established from trend analysis of historical data (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017). The second orientaion is predictive and seeks to understand the future, responding to what could happen. This type of analysis extensively uses data mining and statistical techniques to uncover explanatory and predictive models. These predictive models use historical data accumulated over time to calculate probabilities of future events. The term “advanced analytics” is more appropriately applied at this stage (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017; Nielsen, 2018). Finally, prescriptive analytics aims to answer what should be done based on descriptive and predictive analytical results. Prescriptive analysis consists of an optimization approach, going beyond description and prediction and recommending one or more solutions while showing the probability of outcome for each (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017).

Data analysis provides accountants with tools to examine information from three different perspectives: (i) inference, as it can understand the pattern of accounting transactions and thereby infer action plans; (ii) prediction, as it allows forecasting, for example, future sales demand or inventory performance and thus help in decision making; and (iii) monitoring, as it allows for compliance tasks to be carried out (Schneider et al., 2015). The accounting area can thus make use of the three analytics orientations (Rikhardsson & Yigitbasioglu, 2018; Huikku, Hyvönen, & Järvinen, 2017).

To research the antecedents to the adoption of BA, we chose to use the Technology-Organization-Environment (TOE) model. This model was proposed by the authors Depietro, Wiarda, & Fleischer (1990) to study the adoption of technological innovations by organizations. The model assumes three aspects of a company’s context that can influence the process by which the company adopts and implements technological innovations: technological context, organizational context, and environmental context (Tornatzky & Fleischer, 1990). The technological context includes the necessary equipment and processes and their related internal and external technologies that are relevant to the firm (Tornatzky & Fleischer, 1990). The organizational context is usually defined in terms of descriptive measures, such as: size and scope of the company, its management structure, the quality of its human resources, and the quantity of resources available internally. The environmental context refers to the environment external to the company - industry, competitors, access to resources provided by third parties. and government regulations (Tornatzky & Fleischer, 1990).

Several authors have been using the TOE model in BI&A adoption studies (Ramanathan et al., 2017; Yadegaridehkordi et al., 2020; Sun et al., 2018; Lai, Sun, & Ren, 2018; Bhatiasevi & Naglis, 2020). Among these, the study by Li et al. (2018) stands out by addressing the use of analytics in the postadoption stage, in a subdomain of the accounting discipline, which is internal audit. These studies have in common the adherence to the model constructs as the main factor for its use, thus including factors of organizational and environmental contexts as antecedents to adoption.

3 Methods

This exploratory study adopted a mixed methods approach, using a quantitative and qualitative method to answer the same research question. According to Venkatesh, Brown, & Bala (2013), the mixed methods approach helps the researcher to obtain a broader view and therefore better results than using only

one or another approach. This choice is justified as the study of the antecedents to the adoption of BA in accounting is recent. Figure 1 shows the research design adopted.

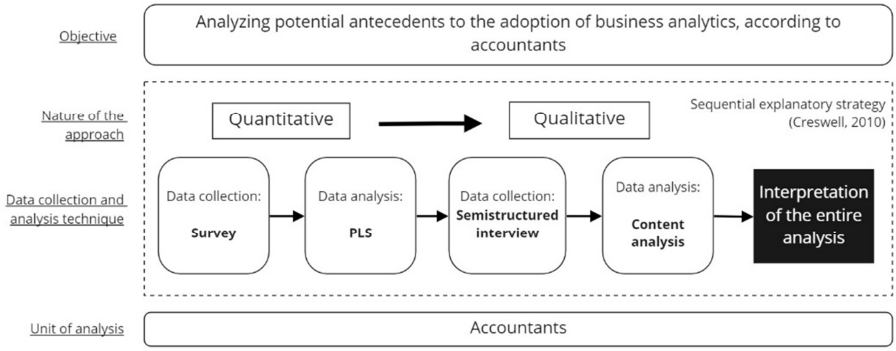

Figure 1 - Research design

Figure 1 points to the use of the sequential explanatory strategy (Creswell, 2010), in which the quantitative study was conducted first, and the results of the quantitative stage served as input for the qualitative step. Interpretation of the entire analysis occurs at the end of the process. According to Creswell (2010), this strategy is useful for using qualitative results to help explain and analyze quantitative results. This research design strategy is justified because although there are several studies on BA adoption using the theoretical lens of the TOE model, there are few empirical studies on BA adoption in the accounting context. Therefore, as suggested by Venkatesh, Brown and Bala (2013), this sequence can provide additional insights based on context-specific results**.**

3.1 Step 1 - Quantitative

The constructs for the TOE model were selected using two criteria: higher incidence of use in BA adoption research, and adequacy to the accounting context. Figure 2 shows the structural model developed for this research.

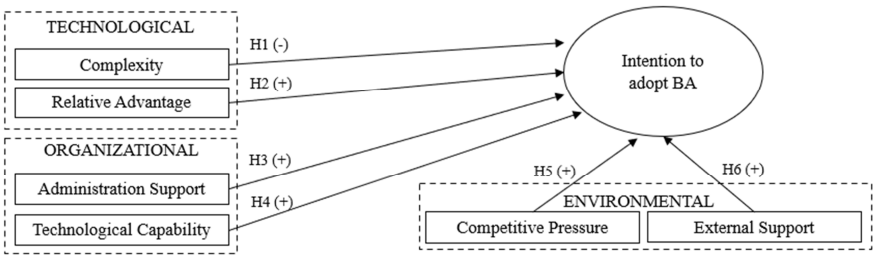

Figure 2 - Structural model of the quantitative step

Figure 2 shows the relationship between the exogenous variables selected for this study and the endogenous variable – Intention to Adopt BA; all relationships are directly related to this one. Figure 3 describes the constructs and hypotheses of this study.

Context	Constructs	Description	Hypothesis
Technological	Complexity	refers to "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2010). As BA may involve data analysis from several internal and external sources, large volumes, and statistical and mathematical analyses, high complexity is expected to delay adoption (Yadegaridehkordi et al., 2020).	H1: The perceived complexity has a negative effect on BA adoption
	Relative Advantage	defined as "the degree to which an innovation is perceived as better than the idea it replaces" (Sun et al., 2018). Aspects such as innovation, productivity, customer value creation, and problem solving were perceived as motivators for adoption (Sun et al., 2018).	H2: Relative advantage has a positive effect on BA adoption
Organizational	Administration Support	is "the degree to which senior management understands the importance of technology and is involved in related activities" (Park et al., 2015). Strong senior management support can help organizations more easily deal with the difficulties and complexities associated with new technologies and increase the rate of adoption (Ramamurthy et al., 2008).	H3: Management support has a positive effect on BA adoption
	Technological Capability	tangible (physical assets) and intangible (human resources, skills, and experience) resources (Iacovou et al., 1995) to implement IT innovations. A well-developed IT infrastructure (hardware, software, and experience) establishes a technical basis for data analytics so that the company can initiate the BA project (Iacovou et al., 1995).	H4: Technological capability has a positive effect on BA adoption
Enrironmental	Competitive Pressure	is the main driving force that leads an organization to seek competitive advantage (Lin, 2014). If organizations feel pressure from their competitors and are aware that they are also implementing an innovation, this will speed up its adoption (Bhatiasevi & Naglis, 2020).	H5: Competitive pressure has a positive effect on BA adoption
	External Support	defined as "availability of support for implementing and using an information system" (Premkumar and Roberts, 1999). The availability of vendor support creates a positive perception of the technology, contributing to the intention to adopt (Maduku et al., 2016).	H6: External support has a positive effect on BA adoption

Figure 3 - Constructs and hypotheses

It is important to highlight that some items of each construct received minor adjustments to suit the position of the accounting area within organizations: whether as core activity or support activity. Therefore, the term “organization” was replaced by “department” so that the respondent can work both in organizations where the accounting activity is the core of the business and in organizations where the accounting activity is a support process. This information was made clear to the participants by adding guidance before the appropriate questions.

The units of analysis are professionals working in any accounting area, regardless of whether they already know and/or use Business Analytics. The organization’s operating segment and size were not delimited either. We made sure the questionnaires were answered by the desired target audience. Data collection in this stage took place through an online sampling survey with the aid of the Google Forms tool.

To estimate the minimum sample size, G*Power 3.1 software was used, available free of charge. For this procedure, we used the number of six predictors of the dependent variable, 0.80 as test power, and 0.15 for effect size (f2), obtaining a minimum sample of 98 respondents. A total of 157 responses were obtained. Respondents with 80% or more responses in only 2 items of the questionnaire were considered outliers (Hair et al., 2014), resulting in 23 outliers. In addition to these, five respondents were subtracted for not working in the accounting area. Thus, the final sample had 129 valid questionnaires, as shown in Figure 4.

Professional profile

Age Group	%
up to 25 years old	22%
from 26 to 35 years old	35%
from 36 to 45 years old	21%
from 46 to 55 years old	17%
over 55 years old	5%
Overall Total	**100%**

Education Level	%
Technical Degree/Graduatic	46%
Specialization	44%
Masters/Doctorate	10%
Overall Total	**100%**

Professional Experience	%
up to 2 years	10%
from 2 to 5 years	16%
from 6 to 10 years	26%
from 11 to 15 years	14%
over 15 years	33%
Overall Total	**100%**

As for BA, you:	%
Do not know it	40%
Know it and DO NOT use it	38%
Know it and use it	23%
Overall Total	**100%**

Training Area	%
Accounting	75%
Accounting and other training	14%
Administration/Law/Economics	8%
Others	3%
Overall Total	**100%**

Main area of Accounting Activity	%
Management accounting	39%
Auditing (Internal or External)	23%
Financial Accounting	17%
Tax Accounting	14%
Expertise Accounting	5%
Accounting Information Systems	2%
Public Accounting	1%
Overall Total	**100%**

Position/Function	%
Technician/Analyst	29%
Coordinator/Manager	24%
Advisor/Consultant	14%
Director/CEO	13%
Assistant	12%
Others	7%
Overall Total	**100%**

Organization profile

Organization Size	%
Individual Company	6%
Microenterprise (annual turnover up to R$ 360 thousand)	10%
Small size (R$ 360 thousand up to R$ 3.6 million)	19%
Medium size (R$ 3.6 million up to R$ 300 million)	32%
Large size (above R$ 300 million)	33%
Overall Total	**100%**

Economic Activity Sector	%
Provision of services (except accounting office)	31%
Accounting office	25%
Commerce	12%
Public sector	9%
Industry	7%
Industry and Commerce	5%
Financial institution	4%
Energy and Electricity	2%
Third Sector	2%
Technology	2%
Overall Total	**100%**

UF	%
RS	88%
SP	6%
MG	2%
SC	2%
BA	1%
MS	1%
SE	1%

IT Team Profile (Top Layer)	%
does not have its own team	27%
own team - operational activities	22%
own team - tactical/managerial activities	14%
own team - strategic activities	37%
Overall Total	**100%**

Figure 4 - Sample characterization

Figure 4 evidences the professional maturity of the survey respondents, as 73% have at least 6 years of professional experience, 66% work as analysts or at higher positions, and the vast majority have higher education in accounting sciences. Management accounting is the predominat activity, and 40% of the respondents mentioned they are not familiar with business analytics. As for the profile of the organizations, the sample is divided into small, medium, and large practically at the rate of 1/3 for each. In addition, more than 50% are service provider organizations, with 25% of the entire sample being accounting offices. Importantly, we decided to keep the respondents who participated in the pretest in the final sample, as the questionnaire did not undergo any modification. The level of maturity of respondents in the pretest remained similar to that of other respondents, and a greater amount of responses allowed performing multigroup analyses that were appropriate for the study.

According to Straub, Boudreau, & Gefen (2004), instrument validation must precede the other statistical validations, as it increases reliability that the instrument will measure the correct content. Therefore, the development of the data collection instrument for this stage and its respective validation followed the steps outlined by Koufteros (1999). These steps consist of: (i) theoretical basis, supporting the interpretation of data results (Marconi & Lakatos, 2004) - to this end, we searched for studies and study instruments that used the TOE model along with the adoption of analytics; and (ii) content validity, which assesses how well the items represent the construct. In turn, face validity assesses when one of the concepts discussed is obviously more pertinent to the meaning of the concept than to the meaning of another concept (Hair et al., 2009; Straub, Boudreau, & Gefen, 2004).

Four specialists evaluated the questionnaire items, all with a bachelor’s degree in accounting and a master’s degree in accounting or administration, three of whom had a doctorate in administration in the area of systems management and information technology. Two specialists suggested adjustments in four items

and the suggested changes were made, obtaining the final version of the questionnaire (Appendix A) for the pretest. The 7-point Likert scale was used (Engel & Schutt, 2013), ranging from strongly disagree to strongly agree. Finally, the pretest was conducted. According to Straub, Boudreau, & Gefen (2004), the pretest is a preliminary test of the instrument that can be useful to qualitatively establish reliability, construct validity, and content validity of the measures (Appendix B).

As data analysis technique, we chose the partial least squares structural equation modeling (PLS-SEM), using SmartPLS and SPSS software. Since these are primary data, the Harman single factor test (Podsakoff et al., 2003) was used to assess the potential bias of the common method. The validations of both the measurement model and the structural model followed the procedures indicated by Hair et al. (2016). The rigorous procedures adopted at this stage of the study were: (i) development of the instrument according to the study by Koufteros (1999), emphasizing theoretical basis, validation with experts, and statistical analyses of the pretest sample; (ii) transparency of the research purpose through formalization at the beginning of the questionnaire; (iii) confidentiality of respondents; (iv) validation of the measurement and structural models according to Hair et al. (2016); and (v) use of SmartPLS software - widely spread among researchers who adopt quantitative approaches - and data analysis by PLS-SEM (Hair et al., 2016).

3.2 Step 2 – Qualitative

The units of analysis in this stage were accountants, who were selected by convenience criteria, seeking to represent a heterogeneity similar to that of the respondents in the quantitative stage. The data collection technique chosen was semistructured interview. In this study, the interview was guided by a list of points of interest of the researcher based on the analysis of quantitative data. Importantly, all interviews were recorded with prior authorization from the participants.

The interview script (Appendix C) was developed based on a literature review and the findings of the quantitative stage. The script was validated by an experienced researcher in the area of information systems and accounting. A total of six interviews were carried out, all with professionals with at least a bachelor's degree in accounting sciences, with an average length of professional experience of seven years. Of these, one declared not to know BA, one declared to use BA, and the others claimed to know but not to use BA.

The data analysis technique adopted was the content analysis technique with hierarchical coding (Krippendorff, 2018). According to Krippendorff (2018), this technique allows the researcher to make replicable and valid inferences for the contexts of its use. As a support tool for qualitative analysis, the NVivo software was used. Hybrid coding was used, considering that the initial and final codes were defined prior to data collection with a theory-driven approach using the factors of the TOE model applied in the quantitative research model. From data analysis, we identified the presence of other factors described in the literature and addressed in the theoretical framework of this study. However, new factors also emerged, being inserted a posteriori with a data-driven approach. A codebook was created and used (Appendix D), being an element of rigor in this study. It contains details of the coding developed, such as number of codes and description of categories and themes, as indicated by Tong, Sainsbury, & Craig (2007).

4 Results

This section comprises the results of the quantitative and qualitative data analysis as well as the interpretation of the entire analysis. According to Venkatesh, Brown, & Bala (2013), the main objective of a mixed methods study is to combine the results of the two methods and enrich the final analysis presenting the metainferences.

4.1 Results of Step 1 - Quantitative

As these are primary data, the Harman single factor test (Podsakoff et al., 2003) was used to assess the potential bias of the common method. The result showed a factor of 31.53%, indicating the absence of common method bias problems, as the reference value should be less than 50%.

As for the measurement model, the following validations were carried out: (i) internal consistency, which "evaluates the consistency between the variables in a multiple scale" (Hair et al., 2009, p. 126). For that, Cronbach alpha was used, which provides a reliability estimate based on the intercorrelations of the indicator variables, which must be > 0.7, as well as composite reliability (CR), which considers the different external loads of the indicator variable, which must be > 0.7 (Hair et al., 2014); (ii) convergent validity, which "evaluates the degree to which two measures of the same concept correlate with each other" (Hair et al., 2009, p. 126), measured by outer loadings - high outer loadings (> 0.7) on a construct indicate the indicators have a lot in common, which is captured by the construct (Hair et al., 2014) - and by the average variance extracted (AVE), which must be > 0.5 (Hair et al., 2014); and (iii) discriminant validity, which "is the degree to which a construct truly differs from the others" (Hair et al., 2009, p. 592), following the Fornell and Larcker criterion in which the square root of the AVE of each construct must be greater than its greatest correlation with any other construct (Hair et al., 2014). Figure 5 shows the results of the validations of the measurement

model.

Constructs	Itens	Outer Loadings	Cronbach Alpha	CR	AVE
Complexity	C2	0,852	0,763	0,890	0,803
	C3	0,938			
Relative Advantage	VR1	0,888	0,900	0,930	0,768
	VR2	0,903			
	VR3	0,904			
	VR4	0,807			
Administration Support	SA1	0,945	0,938	0,960	0,890
	SA2	0,949			
	SA3	0,936			
Technological Capability	CT1	0,775	0,876	0,916	0,732
	CT3	0,804			
	CT4	0,914			
	CT5	0,921			
Competitive Pressure	PC1	0,864	0,706	0,872	0,773
	PC2	0,893			
External Support	SE1	0,898	0,885	0,929	0,813
	SE2	0,916			
	SE3	0,891			
Intention to adopt BA	BA1	0,936	0,914	0,946	0,854
	BA2	0,959			
	BA3	0,875			
Geral			0,879		

Figure 5 - Analysis of reliability and validity of the measurement model

Figure 5 shows that the reference values of Cronbach alpha, Composite Reliability (CR), Average Variance Extracted (AVE), and the outer loadings of the items were satisfied, indicating the internal reliability and convergent validity of the measurement model. This result was obtained after excluding two items from the model: C1 and CT2, respectively, from the Complexity and Technological Capability constructs. The overall Cronbach alpha is 0.879, being above 0.7 as indicated by Hair et al. (2016).

Considering that the model reached satisfactory values for the reliability and convergent validity criteria, discriminant validity analysis was performed as shown in Figure 6, where it is observed that the discriminant validity was satisfied since the square root of the AVE of each construct is greater than the correlation between the factors.

Constructs	BA	COMPL	CT	PC	SA	SE	VR
Intention to adopt BA (BA)	**0.924**						
Complexity (COMPL)	-0.351	**0.896**					
Technological Capability (CT)	0.373	-0.228	**0.856**				
Competitive Pressure (PC)	0.513	-0.168	0.342	**0.879**			
Administration Support (SA)	0.452	-0.268	0.343	0.401	**0.943**		
External Support (SE)	0.576	-0.149	0.422	0.555	0.342	**0.902**	
Relative Advantage (VR)	0.384	-0.191	0.332	0.323	0.386	0.178	**0.876**

Figure 6 - Discriminant validity of the model

As for the structural model, validations were carried out following Hair et al. (2016). The first step was thus the analysis of collinearity, which is an expression of the relationship between the items. Collinearity is measured by the Variance Inflation Factor (VIF), which must remain between 0.20 and 5 (Hair et al., 2016). All model factors were within this range of reference values, ranging between 1,108 and 1,627, indicating that the results were not negatively affected by collinearity.

The next step was to evaluate the path coefficients that represent the hypothesized relationships between the constructs (Hair et al., 2016). In this step, "t" values represent the relationship between the original data values and those obtained by the resampling technique (bootstrapping with 5000 samples). Critical "t" values for a two-tailed test are 1.65 (significance level = 10%), 1.96 (significance level = 5%), and 2.57 (significance level = 1%), and the p-value must be less than 0.10 (significance level = 10%), 0.05 (significance level = 5%), or 0.01 (significance level = 1%) (Hair et al., 2016). Figure 7 shows the result of testing the hypotheses of the structural model.

Hypothesis	Hypothesized Path	Path Coefficient	T Statistic	p-value	Empirical Evidence
H1	COMPL->BA	-0.196	3.075	0.002	Suported
H2	VR->BA	0.173	2.625	0.009	Suported
H3	SA->BA	0.137	1.518	0.129	Not Suported
H4	CT->BA	0.011	0.156	0.876	Not Suported
H5	PC->BA	0.155	1.741	0.082	Not Suported
H6	SE->BA	0.379	4.451	0.000	Suported

Figure 7 - Hypotheses testing

Figure 7 shows that hypotheses H1, H2, and H6 were supported with a significance level < 0.01%, respectively indicating that complexity negatively impacts the intention to adopt BA and that relative

advantage and external support positively impact the intention to adopt BA. Hypotheses H3, H4, and H5 were not supported, statistically indicating that management support, technological capability, and competitive pressure do not affect the intention to adopt BA. As for management support not having a significant effect on the intention to adopt BA in accounting (H3), a possible explanation is the lack of understanding of the possibilities that BA can offer for the context of use (Lai, Sun, & Ren, 2018). For H4 - technological capability not having a significant effect on the intention to adopt BA in accounting, the authors Lai, Sun, & Ren (2018), who also had this hypothesis rejected, point out two possible causes: (i) organizations can hire external support to make up for the lack of internal technological capability; and (ii) lack of familiarity with the new technology, not knowing how to use and operate it, nor what resources are needed. As for competitive pressure being rejected, none of the studies reviewed had similar results. These unsupported relationships were intensely explored in the qualitative stage of this study, which will be presented in the next subsection.

The third assessment of the structural model is the coefficient of determination (R^2), which measures the predictive accuracy of the model (Hair et al., 2009). The R2 represents the percentage of variation in the response that is explained by the model (Hair et al., 2016). Thus, values of 0.75, 0.50, or 0.25 for the endogenous constructs can be respectively described as substantial, moderate, and weak (Hair et al., 2016). Figure 8 presents this result.

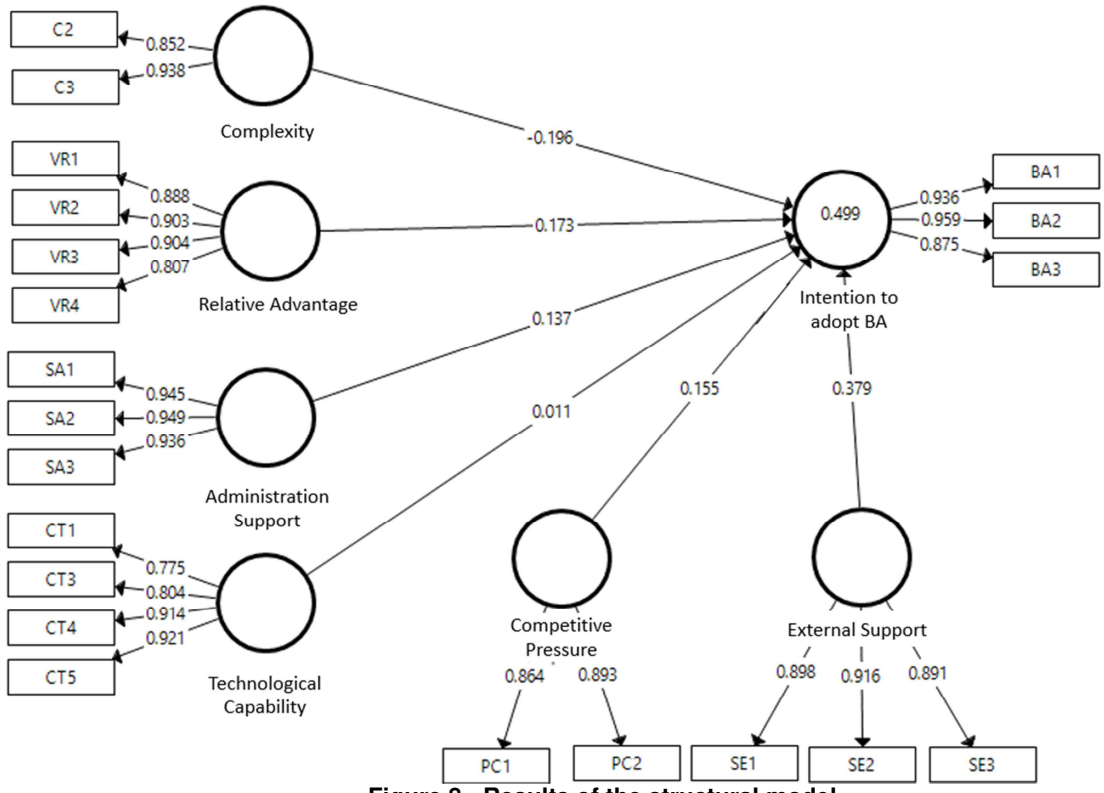

Figure 8 - Results of the structural model

Figure 8 shows that this model explains 49.9% (R^2 = 0.499) of the intention to adopt BA in accounting, being classified from weak to moderate. In addition, the f2 effect size assesses the contribution of an exogenous variable to the R^2 value of an endogenous latent variable (Hair et al., 2016). According to Cohen (1988), the guidelines to assess f2 are that values of 0.02, 0.15, and 0.35 respectively represent small, medium and large effects. In this study, only the external support (SE) construct had a medium effect on the intention to adopt BA (BA). Technological capability (CT) had no effect, and the other construcs had a small effect.

As the last step indicated by Hair et al. (2016), the predictive relevance of the model was verified using the Stone-Geisser Q2 indicator, which is estimated by the blindfolding procedure and represents a measure of how well the path model can predict the values originally observed. The value of this indicator should be > 0 (Hair et al., 2016). The calculated Q2 of 0.407 indicates the predictive relevance of the model. The results evidence that this model explains 49.9% of the intention to adopt BA in accounting, with the external support factor having the greatest contribution. This result corroborates Caldeira (1998) in that external support is especially important for small organizations.

In order to deepen the quantitative analysis of the study, multigroup analysis (MGA) was performed with the support of SmartPLS to compare various groups of respondents. According to Hair et al. (2016), this procedure allows testing whether there are statistically significant differences between different groups of

data for the same model, being beneficial for both the practical and theoretical perspectives. The categorical variables of the questionnaire that could form groups meeting the minimum requirements of the “rule of thumbs” were verified (Hair et al., 2016, p. 250), so only those that formed subgroups with at least 40 respondents were selected. Therefore, the following subgroups were formed: (i) knows BA and does not know BA (respondent profile); (ii) with and without IT or operational IT, and managerial or strategic IT (organization profile); and (iii) small, medium, or large size (organization profile). The other categorical variables that did not satisfy this condition –accounting area of activity, segment of activity and sector of economic activity – were not used for the multi-group analysis. Figure 9 presents the hypotheses with differences.

Hypothesis	Hypothesized path	Supported	Not Supported
H1	COMPL->BA	Does not know BA	Knows BA
		Without IT or Operational IT staff	Managerial or Strategical IT
		Small Size	Medium or Large Size
H2	VR->BA	Knows BA	Does not know BA
H4	CT->BA	Without IT or Operational IT staff	Managerial or Strategical IT
H5	PC->BA	Managerial or Strategical IT	Without IT or Operational IT staff
H6	SE->BA	Small Size	Medium Size

Figure 9 - MGA analysis

Figure 9 shows that the COMPL->BA hypothesis was the one that showed the most differences between the analyzed groups. This hypothesis was not supported for the groups formed by respondents who know BA and have an IT team with medium and large managerial and strategic activities. The VR->BA hypothesis was not supported for the group of respondents who do not know BA. The CT->BA hypothesis was not supported for respondents whose organizations have an IT team with a managerial or strategic role. The PC->BA hypothesis was not supported for respondents from organizations without an IT structure. Finally, the SE->BA hypothesis was not supported for respondents from medium-sized organizations. The only hypothesis that did not generate a significant difference between these groups, which was not supported, was SA->BA. These differences will be explored in the next stage of qualitative approach, seeking better understanding. Based on Figure 10, it is inferred that: some categorical variables have a moderating effect, allowing the elaboration of complementary hypotheses to the initially proposed model, namely:

Complementary Hypothesis
H1a: Prior knowledge of BA moderates the relationship between complexity and the intention to adopt BA;
H1b: The IT staff profile moderates the relationship between complexity and the intention to adopt BA;
H1c: Organization size moderates the relationship between complexity and the intention to adopt BA;
H2a: Prior knowledge of BA moderates the relationship between relative advantage and the intention to adopt BA;
H4a: The IT staff profile moderates the relationship between technological capability and the intention to adopt BA;
H5a: The IT staff profile moderates the relationship between competitive pressure and the intention to adopt BA;
H6a: Organization size moderates the relationship between external support and the intention to adopt BA.

Figure 10 – Complementary hypotheses

4.2 Results of Step 2 - Qualitative and Aggregated Results with the quantitative step

The objective of data analysis of the qualitative stage was to complement and explain the results found in the previous quantitative stage by obtaining different views of the same phenomenon: the factors that impact the intention to adopt BA in accounting. Therefore, in this section, the results of the quantitative and qualitative stages are presented, as well as the discussion with the literature.

4.2.1 Variables not supported in the quantitative step and supported in the qualitative step.

In this section, the antecedent factors of adoption that were supported in the qualitative stage are presented, although not supported in the quantitative stage. In the organizational context, respondents elected management support as a very important factor that positively impacts BA's adoption in accounting. According to ENTR3: "Not only does it impact, but it may be critical. Not only support for adoption, but also provide the tools and skills necessary for this process" and ENTR6: "I think it is the main factor that impacts the decision to adopt or not. I think it's quite that thing: who's my client. Our [accounting] main client will always be senior management, so it is the main impact." These arguments are in line with several studies on the adoption of BI&A independent of the segment, size and location of organizations (Li et al, 2018; Yadegaridehkordi et al., 2020; Bhatiasevi & Naglis, 2020; Sun et al., 2018; Ramanathan et al., 2017; Lai et

al., 2018). However, as this factor was rejected in the quantitative study, we sought to explore, with the respondents, possible reasons for this result. Among the possible causes, it was pointed out that senior management tends to prioritize support for BA projects in the main business processes of the company, where the return can be faster. Another possible cause raised is the distance between senior management and the accounting area.

Another factor explored in the interviews was technological capacity. For the professionals interviewed, technological capacity positively impacts the intention to adopt BA, as it is the "necessary basis for implementation – it is the foundation" (ENTR1). They reinforce that having an IT structure and staff available facilitates the intention of adoption in accounting, by already knowing the structure of the company and disseminating the culture of data analysis. When asked about the possible causes of the hypothesis not being supported in the quantitative study, they generally attributed the: (i) possibility of external contracting, corroborating the study by Lai et al. (2018), (ii) difficulties in accessing or destructuring databases for use.

In the environmental context, regarding the competitive pressure factor, most respondents do not realize that there is currently a tension in the accounting area by pressing the intention to take BA and justify it because it is something new (ENTR4). They also point out that the type of accounting service provision acts as a moderator of this driver, such as large audit firms and companies specializing in accounting information systems would be more likely to feel pressured by competitors (ENTR5) However, ENTR6, which already uses BA, argues: "It is a current view. If I'm not providing relevant information to my customers, I'm losing competitive advantage." Ergo, it can be inferred that: competitive pressure is a construct that has significant moderating elements.

Figure 11 presents the synthesis of the results of the variables not supported in the quantitative study and how they appear in the qualitative study, the discussion with the literature and the respective inferences from the research data.

Antecedents to the adoption of BA in accounting	Quantitative study	Qualitative study	Literature	Inference
ORG: H3: **Management support** has a positive effect on BA adoption	Not supported	Supported	Supported by studies of Li et al. (2018), Yadegaridehkordi et al. (2020), Bhatiasevi & Naglis (2020), Sun et al. (2018), Ramanathan et al. (2017) and Lai, Sun, & Ren (2018).	Senior management does not prioritize the focus of BA projects in the accounting area.
ORG: H4: **Technological capability** has a positive effect on BA adoption	Not supported, being supported for companies without an IT structure	Supported	Supported by studies of Yadegaridehkordi et al. (2020), Sun et al. (2018), and Bhatiasevi & Naglis (2020). Not supported by the study of Lai, Sun, & Ren (2018). The latter authors point out as a possible justification the possibility of contracting the necessary resources externally.	Technological capability is important for BA adoption as: (i) it can be achieved through third parties and (ii) unstructured or unaccessible databases diminish the intention to adopt BA.
AMB: H5: **Competitive pressure** has a positive effect on BA adoption	Not supported, being supported for companies with a strategic or managerial IT structure	Partially supported depending on moderating variables: type of organization	Supported by studies of Yadegaridehkordi et al. (2020) and Bhatiasevi & Naglis (2020).	In the accounting context, competitive pressure has moderating variables and has no relevant effect on the intention to adopt BA.

Figure 11 - Synthesis of the results of the variables not supported in the quantitative step

From Figure 11, it is observed that the three hypotheses not supported in the quantitative step were supported in the qualitative one, corroborating other studies in the literature. As for the variable technological capacity, studies were found where it was supported and in others not supported.

4.2.2 Variables supported in qualitative step

In this section, the antecedent factors of adoption that emerged from the qualitative step are presented. Some of these factors have been found in the literature in other studies. In the technological context, the cost of adoption was pointed out by the respondents as a factor that can negatively impact the intention to adopt BA, corroborating the research by Wang et a.l (2016). According to Yadegaridehkordi et al. (2020) the cost for adoption includes investments in hardware, software, hiring professionals with analytical skills and training. Another factor that emerged with a potential positive impact on the intention of adoption was observability, which refers to the characteristics of technological innovation being perceived as beneficial after observing how other organizations use them (Sun et al., 2008). In this sense, ENTR4 argued: "I believe it would be very good that it had more success cases, much more disclosed among companies so that it gave the accounting professional this security." Finally, the last aspect highlighted by one of the respondents as a factor that can impact on the adoption was the confidence in the results presented by BA, in the understanding that the accounting professional needs to have about how the tool explores the data and arrives at certain values. This tension caused by the automation of certain analyses

and the possibility of using a larger volume of data and external sources was highlighted by Knudsen (2020).

Accounting positioning was highlighted by respondents as a factor that can impact the intention to adoption of BA. According to the respondents, these aspects are related to how the accounting function is seen by senior management and its peers: strategic or operational, and concerns how accounting professionals position themselves within organizations. Examples of this element follow: (i) "I think it depends a little on the culture of the company, how much it sees accounting like this, because sometimes accounting can be just the one that records the balance sheet, which does the basics. Sometimes it can be accounting that actually assists in decision making that is consistent with current accounting standards, with CPC's (Accounting pronouncements issued by the Accounting Pronouncements Committee), so I think it depends on that involvement as well, on how important accounting is for the business" (ENTR5) and (ii) "Shows the tendency of accounting to be a bubble sometimes, a world apart" (ENTR1). Finally, ENTR3 argued that depending on the accounting subarea, if they are areas with more managerial profiles, they can receive greater management support for the adoption of BA. Therefore, it is inferable that this accounting positioning driver could even act as a moderating factor in the model.

The size of the organization was also pointed out. This factor is in line with the authors Zhu et al. (2006) because, in general, larger companies have greater investment and infrastructure capacities and are open to taking more risks in the face of technological innovations. Another factor raised by one interviewee was the availability of time, arguing that in scenarios where the accounting sector is overloaded and sometimes with difficulty in meeting normal deadlines, it will decrease the intention to adopt technological innovations.

In the environmental context, some respondents pointed out the regulatory pressure as an important driver of the adoption of technology in the accounting area, as highlighted by the authors Li et al. (2018) although there is no obligation to use BA in accounting, the incentive of regulatory bodies could already act positively in the intention of adoption. According to ENTR3 "accounting works with mandatory (systems) processes to actually adopt. As BA is not something mandatory, perhaps still many accountants are not seeing this need for adoption", on the other hand ENTR6 points out that because Brazil has a strong tax emphasis, many accounting professionals specialize in complying with tax legislation and do not develop in technology, with this negatively impacting the intention to adopt BA. It is therefore inferable that: regulatory bodies can play an important role in encouraging the development of technological skills in the accounting professional and in the adoption of BA.

Uncertainty/concern about risk was also pointed out by some respondents as a factor that negatively impacts the intention of adoption (ENTR1; ENTR4). In the literature, the authors Sun et al. (2018) denominate uncertainty/concern about risk as the fear of not having the return on investment and point out that the trade-off between benefit-risk is an important factor for adoption.

Another element highlighted during the interviews was the effect of the type of organization of the accounting professional's performance in the intention of adopting BA - being type of organization: accounting offices and other organizations characterized by having internal accounting structure - emphasizing that accounting offices would tend to decrease the intention of adoption, while accounting inserted in other types of organizations internally, would increase the intention of adoption. The following justifications are: (i) risk of the tool not impacting so abruptly the activities developed by the accounting offices (ENTR3), (ii) the client profile of the accounting office of not valuing more robust analyses (ENTR1, ENTR2), (iii) office activities aimed at meeting regulatory obligations (ENTR2), (iv) passive resistance (ENTR2); on the other hand, ENTR5 points out that accounting offices with innovative vision, auditing companies and accounting information systems are more likely to adopt BA. It is then inferred that: the type of organization can act as a moderating effect on the intention to adopt BA.

In addition to the factors of the contexts of the TOE model, in the qualitative step, important human elements evidenced by the respondents as antecedents of the adoption of BA in accounting, related to the accounting professional, were identified. In this sense the research of Yadegaridehkordi et al. (2020) combined the TOE model with the Human-Organizational-Technology (HOT) model created by the authors Yusof et al. (2008) incorporating factors of the human context as potential antecedents of the adoption of big data. In this study, evidence of the importance of the efficacy factor of change was observed, different from the study by Yadegaridehkordi et al. (2020) where it was not significant. The concept of effectiveness of change in TOE, according to Weiner et al. (2008), is the extent to which the members of the organization are psychologically and behaviorally prepared to implement organizational change, forming readiness for change. In this sense one can observe some collected data that corroborate this factor: (i) "Sometimes it is very comfortable, they are very accustomed, they do not stop to think about this strategic sense of the business model, it is profiting, it is working, they do not see technology often as a threat" (ENTR1), (ii) "Because of the issue of the new, people get scared" (ENTR2) and (iii) "I think it's much more a perception, I say more in this view of accounting offices, it's that thing: my operation continues without any change, but I'm showing that I'm updating myself in technology in what I to the top layer, while in the bottom layer still remains the same rice and beans[i]" (ENTR6). Ergo, it is inferred that: there are some profiles of accounting professionals with greater difficulty in implementing changes for behavioral reasons.

At last, another factor related to the human context evidenced was called technical skills of the

accounting professional. The respondents emphasized that the more technical skills the professional has, the greater the intention to adoption the technology. They highlight the need for qualification to treat and analyze the data, both from the technological point of view and to "know how to deal with the information that is provided by BA to have insights to make better decisions" (ENTR3), also through statistical knowledge and data mining (ENTR5). In this sense, ENTR4 points to the problem of the scarcity of accounting professionals with analytical profile, due to the lack of structured programs in educational institutions and class entities, making the professional who wants to update need to seek support in other types of training or count on the support of other types of professionals in the data area. Therefore, it is inferred that: as accounting professionals seek to develop analytics skills, they will be more inclined to adopt BA solutions. The technical skills factor of the accounting professional that emerged from the qualitative stage data is similar to the knowledge in business analytics considered one of the organizational human resources of the literature of The Big Data Analytics Capabilities (Mikalef et al ., 2018). In this literature, human resources, together with other tangible and intangible resources, are considered important to leverage the strategic potential of big data. Although there are three key differences between big data analytics and business analytics (McAfee et al., 2012) – speed, variety and volume – this similarity is understood to be seen in future studies.

Figure 12 summarizes the factors that emerged in the qualitative step, organized by the technological, organizational, environmental and human contexts, comparing them with findings from other studies and presents the inferences from the research data.

Antecedents to the adoption of BA in accounting	Literature	Inference
TEC: Cost of adoption	Cost of adoption was not supported by the quantitative study of Yadegaridehkordi et al. (2020), with 70% of the sample comprising medium-sized companies. However, it was supported in the qualitative study of Sun et al. (2018).	The cost of adoption can negatively impact the intention to adopt BA, especially in smaller organizations, as they usually have less investment capacity.
TEC: Observability	This factor was evidenced in the qualitative study of Sun et al. (2018), but with a low ranking. According to the authors, this indicates that this factor does not play a very significant role in relation to others.	Observing how BA is used in other organizations contributes, albeit to a lesser extent, to the intention of adoption.
TEC: Reliability	This factor was listed in the qualitative study of Sun et al. (2018), but at the institutional level.	Accountants are responsible for the accuracy of the information they present, so they tend to seek greater understanding of the tool they use so that they can trust the results presented.
ORG: Accounting positioning	-	Accounting positioning - operational or strategic - within the organization moderates the relationship between management support and the intention to adopt BA.
ORG: Organization size	Supported by studies of Yadegaridehkordi et al. (2020) and Sun et al. (2018), not supported by the study of Li et al. (2018).	Organization size can be seen as a moderating effect on the intention to adopt BA.
ORG: Time availibility	-	Some subareas of accounting are subject to legal deadlines for compliance with obligations, so time availability may negatively impact the intention to adopt BA.
AMB: Regulatory pressure	Supported by studies of Sun et al. (2018), Li et al. (2018), and Lai, Sun, & Ren (2018).	Regulatory bodies can play an important role in the intention to adopt BA.
AMB: Uncertainty/concern about risk	Evidenced in the qualitative study of Sun et al. (2018).	Uncertainty about the return on investment negatively impacts the intention to adopt BA.
AMB: Type of organization	-	The type of organization in which the accountant works has a moderating effect on the intention to adopt BA.
HUM: Effectiveness of change	Not supported by the study of Yadegaridehkordi et al. (2020) with managers of small and medium-sized hotels.	Accountant readiness, in terms of softskills, positively impacts the intention to adopt BA.
HUM: Technical skills of the accountant	-	The technical skills (hardskills) of the accountant positively impact the intention to adopt BA.

Figure 12 - Synthesis of the results of the variables emerged in the qualitative step

From Figure 12, it can be observed that in the organizational and environmental context factors have emerged not evidenced until then in the literature and related to the accounting environment, and it can be

inferred that there are antecedent factors of the adoption of BA specific to the accounting domain.

4.2.3 Variables supported in the quantitative and qualitative steps

In this section, the contributions of the qualitative step are presented, corroborating the variables supported in the quantitative step. In the technological context, respondents explained how complexity can negatively impact the intention to adopt BA under certain conditions, and what elements can contribute to increase or decrease complexity. The moderating effect of the profile of the internal IT team was highlighted, which, if it already has familiarity with the tool and work together with the accounting area in the implementation and support, will contribute to reduce the complexity perceived by the accounting professional. Another moderator effect observed was the company's previous knowledge and size, as highlighted by ENTR6: "If I don't know BA, I don't have IT, I'm a small business, so it makes sense for complexity to be impacted, because it's the first time I'm thinking about it." Another aspect pointed out is in which stage of an adoption project accounting will be involved, since the initial stages of data choice and preparation would require greater mental effort from accounting professionals than if they assume a role of end users of the application, as ENTR1 pointed out: "The accounting professional has to know what information wants from this BA and this requires a little mental effort, of stop, of reflection that, sometimes, in the rush of daily life we are not accustomed".

Regarding the relative advantage, all respondents point out, as the main advantages for the accounting area in the adoption of BA, the opportunity to perform better management analysis, with more agility and robustness from the insights generated by the data, impacting on the better provision of service for both internal users of accounting information and external customers in the case of outsourcing of accounting. ENTR3 reinforces the aspect of management analysis: "There is much to contribute to accounting activities, not only related to these more operational issues, but focused on insights for cost reduction, or pricing issues, but can also positively impact and can greatly assist in management issues" and ENTR2 highlights the benefit in providing service in "BA certainly should bring revenue growth inclusive". Therefore, it is inferred that: the adoption of BA allows accounting to improve the provision of services for both internal and external customers.

In the environmental context, external support, although highlighted by respondents as not currently evidenced through incentives from suppliers for the adoption of BA in the accounting area, as for example in "No, for the accounting segment no. I don't see anything focused. Accounting is in the background for these companies" (ENTR6), it is an important antecedent of BA's adoption in accounting, corroborating the research of Yadegaridehkordi et al. (2020), Bhatiasevi & Naglis (2020), Sun et al. (2018) and Li et al. (2018). The quantitative results showed this importance, since it was the construct with the greatest relevance of the model and among the accounting professionals interviewed, all pointed out that external support positively impacts on the intention of adoption, such as: "So I think so, they positively impact, especially by providing a tool of easy access, friendly and also by providing skills for people to be capable of making the best use of the tool and in a way that they actually get results by using them." (ENTR3). Therefore, it is inferable that: BA solution providers can play an important role in encouraging adoption in the accounting area. Figure 13 summarizes the variables supported in both stages and inferences from the research data.

Antecedents to the adoption of BA in accounting	Quantitative study	Qualitative study	Literature	Inference
TEC: H1: **Complexity** has a negative effect on the intention to adopt BA	Supported with small effect, not being supported for groups: familiar with BA, with strategic IT team, and medium and large companies	Supported with moderating variables: IT staff profile, prior knowledge, and organization size	Complexity was not supported by the quantitative studies of Yadegaridehkordi et al. (2020) and Lai, Sun, & Ren (2018). The latter authors justified this outcome by the sample comprising technology companies that do not consider BA complex and that can hire experts to complement any knowledge gaps.	The perception of the complexity of BA tends to decrease as organizations have greater investment capacity, both internal and external, and prior knowledge of BA.
TEC: H2: **Relative advantage** has a positive effect on BA adoption	Supported with small effect, not being supported for those unfamiliar with BA	Supported	Supported by studies of Yadegaridehkordi et al. (2020), Sun et al. (2018), and Lai, Sun, & Ren (2018).	Anyone who knows BA recognizes its relative advantage over other technological solutions, increasing the intention to adopt it.
AMB: H6: **External support** has a positive effect on BA adoption	Supported, not being supported for medium-sized companies	Supported	Supported by the study of Yadegaridehkordi et al. (2020), not supported by studies of Li et al. (2018) and Bhatiasevi & Naglis (2020).	External support has a positive effect on the intention to adopt BA, with organization size as a moderating effect.

Figure 13 - Synthesis of the results of the supported variables

It is important to point out, as shown in Figure 13, that these three antecedents of adoption – complexity, relative advantage and external support – have been ratified by this study, through the convergence of results of the quantitative and qualitative steps.

4.2.4 Expanded BA adoption framework in accounting

Figure 14 presents the framework resulting from this study. Based on Figure 14, we can observe the moderating factors of the model, as evidenced by the multi-group analyses performed and by the analysis of qualitative data. It is verified, through the caption in the figure, the factors derived from the quantitative or qualitative phase and with previous studies in the literature (theory-driven) or originated from the data-driven data.

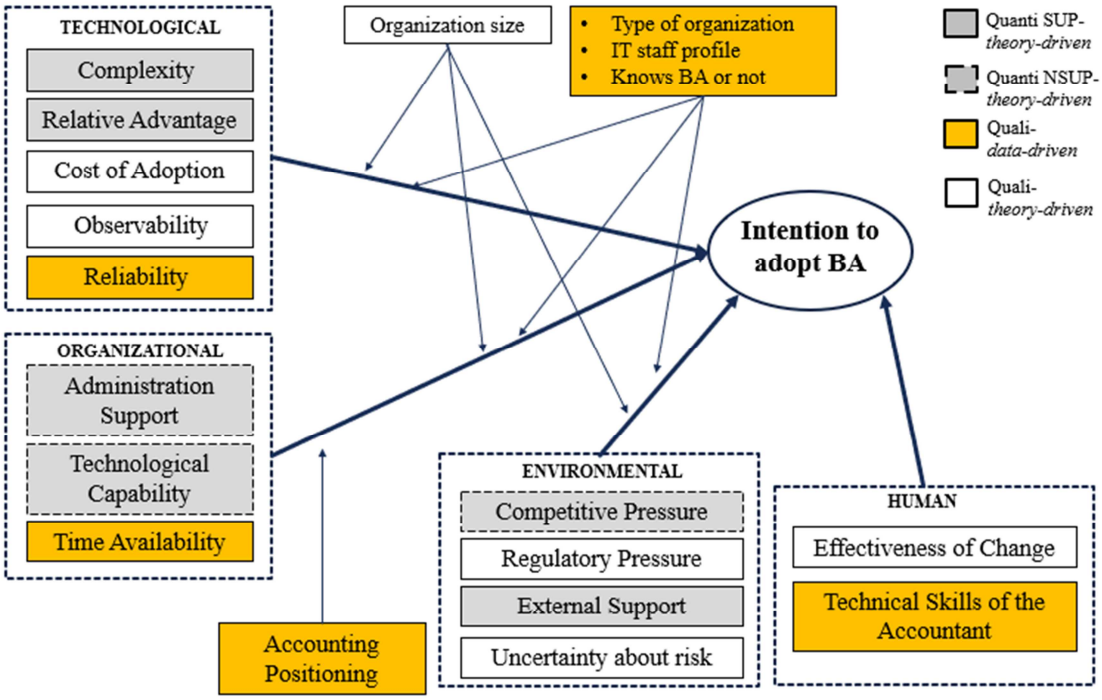

Figure 14 - Expanded framework of BA adoption in accounting

From this figure it can be concluded that there are several factors that impact the intention to adopt BA in accounting, in addition to the hypotheticals in the quantitative model. Technological factors stand out because three other factors emerged: cost for adoption, observability and confidence in addition to previously supported factors: complexity and relative advantage. Another important aspect is the identification of human factors extrapolating the original TOE model and corroborating the research of Yadegaridehkordi et al. (2020). Furthermor, it is highlighted elements and moderator factors specific to the accounting context, such as: accounting positioning and type of the organization.

4.4 Key contributions and suggestions for future studies

Five factors of the technological context that negatively or positively impact the intention to adopt BA in accounting were identified. With a negative effect, the complexity attributed to the new technology and the cost for adoption. It can be inferred that these factors were strengthened by the presence of professionals working in small and medium-sized organizations, corroborating the studies by Li et al. (2018) and Yadegaridehkordi et al. (2020) that indicate that smaller companies have lower investment capacity. Another element of emphasis was the confidence factor brought as the need for the professional to understand in order to be able to trust the results presented from the applications of BA, which meets the analytical profile that is characteristic of accounting professionals (Perkhofer et al., 2019).

Another important contribution was the hypothesis that the management support did not have a significant effect on the intention to adopt BA in the quantitative study, since this director is already well consolidated in the IS literature as relevant for the adoption of new technologies (Caldeira, 1998) and especially in the context of the use of BA that transcends technological issues permeating organizational processes and causing a change of culture to decision-making based on (Holsapple et al., 2014). By exploring this result in the qualitative stage, structural critical elements emerged about the accounting positioning within organizations, if seen as a strategic or operational function, and can act with a moderating effect in the intention of adopting BA. Still in the organizational context, the technological capacity factor is highlighted as not quantitatively supported, the result of which resembles the research of Lai et al. (2018). These authors judged that this unsupported factor may have among the reasons the possibility of companies contracting these necessary capabilities for adoption externally. In this sense, it would corroborate the external support factor having had a medium effect on the intention to adopt BA, as statistically supported

result. Also in the environmental context, competitive pressure and regulatory pressure were identified as environmental factors that can positively impact the intention to adopt BA, corroborating the study by Li et al. (2018) who worked the "standards" factor to represent the normative aspects as a driver in the adoption of analytics in the area of accounting auditing.

Another important contribution of this study was the identification of human factors that impact the intention to use BA. The human factors identified concern the predisposition of the accounting professional to implement the BA and whether it has the technical skills needed to actively partake in the adoption process. The first element has theoretical basis, being called the effectiveness of change and was found in the researches of Yadegaridehkordi et al. (2020) and Yusof et al. (2008). The second element resembles one of the capabilities of big data analytics (Mikalef et al., 2018), identified as knowledge in BA, constituting the identification of this similarity an important theoretical contribution, hence suggests future studies in order to better explore these factors and verify whether they can be treated as antecedents of the adoption of BA and levers to enhance the use of big data analytics.

Some moderating elements of the adoption intention were also evidenced in the quantitative study and were statistically tested through multi-group analysis and constitute an important theoretical and practical contribution. Still others have come from the qualitative study and joined forces by including more contributions. The following stand out: (i) type of organization, in the accounting context clearly segregated accounting offices and other organizations characterized by having internal accounting structure, (ii) size of the organization, a factor that finds support in the literature (Li et al., 2018; Yadegaridehkordi et al., 2020; Sun et al., 2018), (iii) IT team profile and (iv) previous knowledge of BA. Thus, it is suggested to explore the expanded framework resulting from this study in future research.

The interviewees pointed out that, by using BA's potential, accounting can highlight and strengthen its main function of providing valuable information for decision making, giving transparency about the real and projected situation of the business. In this sense, future research on the effects of BA adoption on accounting is suggested, which may serve as a driving force for new adoptions, since the antecedent "observability" emerged from qualitative research data as an element that can contribute to the intention of adoption.

5 Final Considerations

This study aimed to analyze potential antecedents to the adoption of business analytics according to accountants. For that, we used the TOE model as a theoretical lens (Depietro, Wiarda, & Fleischer, 1990), which assumes that factors from technological, organizational, and environmental contexts impact the adoption of technological innovations. We adopted a mixed methods approach with a sequential explanatory strategy (Creswell, 2010), with the quantitative part operated by an online survey and the qualitative part operated by semistructured interviews. Both stages had as units of analysis accountants from different segments of activity, company sizes, and areas of expertise.

Technological, organizational, and environmental factors based on the literature review were quantitatively tested and analyzed in the first stage of the study. Then, in the qualitative stage, which aimed to complement and extend the findings of the quantitative stage, factors that were not initially supported were discussed, as well as other factors that could positively or negatively impact the intention to adopt BA in accounting were evidenced. This study therefore achieved its objective, as it presented a set of different factors that, according to accountants, impact the intention to adopt BA.

Among the main theoretical contributions, we highlight the technological, organizational, environmental and human factors that, according to accounting professionals, positively or negatively impact the intention to adopt BA in accounting. Another important contribution was the evidence of moderating variables of the intention of adoption, which are important subsidies for future research, allowing to identify whether, in other application domains, these variables will find the same support, or if they will find analogous variables according to specific domains. Factors such as trust, observability, accounting positioning, effectiveness of change and external support stood out in this study and contribute to the understanding of BA adoption in the accounting field, since accounting is present in all types and sizes of organization, is an outsourced activity and submits to regulatory issues.

It is important to point out that, by identifying factors that tell apart companies with a greater propensity to adopt BA from those that would not adopt it, the results of this study are equally important for the accounting community, managers and technology suppliers because, having knowledge of these elements, they can proactively act in the removal of barriers to the adoption of BA, making accounting science strengthen its main role of being a source of information for the decision making (Rikhardsson & Yigitbasioglu, 2018; Appelbaum et al., 2017).

As a limitation of the study, we point out the non-proportionality of respondents in the different areas of accounting during the quantitative stage. This results in the inferences made representing the performance of the accounting professional in general lines, the absolute generalization of the results for all areas isn't possible, though, but only analytical generalization (Yin, 2015). As an effect there may be well-defined clusters of perceptions that have not been captured. In this sense, future research is suggested

focusing on areas that give evidence of having particularities associated with the adoption of BA. Moreover, in the qualitative stage, the bias of respondents (specialists, in the case of this research) is also pointed out as a limitation, which do not necessarily represent the heterogeneity found in quantitative research (users, in this case). Because of this, it is suggested to broaden the focus of the interviews also to include the audience of adopters, who can represent the intentions of adopting BA in accounting.

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[i] Brazilian version of “bread and butter”.