

Intellectual capital, sustainable economic and financial performance and value creation in emerging markets: the case of Brazil

Intellectual
capital

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Abstract

Purpose – The purpose of this paper is to analyze the influence of intellectual capital (IC) on sustainable economic and financial performance (EFP) and value creation (VC) in Brazilian companies.

Design/methodology/approach – Based on finance and accounting theories, a quantitative and descriptive long-term study was carried out in the companies listed on the Brazil Stock Exchange and Over-the-Counter Market (B3), covering 20 years period.

Findings – The results indicate that IC positively influences profitability, corporate return and organizational value sustainably; the most intangible-intensive Brazilian companies listed on B3 presented more robust results than the least intangible-intensive; and IC contributes to a systematic increase in EFP and VC over time.

Research limitations/implications – Using a well-established metric, the IC-INDEX, the IC and its effects were measured, obtaining theoretical contributions (expanding the understanding of the IC influence in sustainable EFP and VC from a long-term perspective – one subject still unexplored in the literature); and

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empirical (increasing the understanding of the IC's role as a driver of competitiveness, performance and organizational value).

Practical implications – This study increases the understanding of the theoretical and practical effects of IC, also providing a competitive benchmarking process to access sustainable EFP and VC of companies and their industries.

Originality/value – The originally applied and validated proposal extends existing theory by offering a set of indicators to scale the contribution of IC to competitiveness from the perspective of long-term (historical) corporate outcomes.

Keywords Sustainability, Intellectual capital, Brazil, Emerging markets, Value creation, Economic and financial performance

Paper type Research paper

Introduction

In the knowledge-based economy, issues involving intellectual capital (IC) have been gaining prominence in the academic, legal and business communities because IC is increasingly recognized as the main element for improving competitiveness, innovation and value creation (VC) for organizations (Xu and Liu, 2020; Jordão and Novas, 2017). The international literature (Xu and Liu, 2020; Nadeem *et al.*, 2019; Dumay, 2009) clarifies that the study of IC and its measurement represents one of the most challenging and complex areas of finance, accounting, law and economics, whether in theoretical or practical terms.

According to Jordão and Almeida (2017), the challenge of understanding the extent to which IC influences sustainable (long-term) economic and financial performance (EFP) – in terms of profitability and corporate return – and VC is yet to be examined, especially in complex emerging economies such as Brazil.

Recognizing and exploring this research gap, this paper analyzes the influence of IC on sustainable EFP and VC in Brazilian companies, through a study that was carried out in the companies listed on the Brazil Stock Exchange and Over-the-Counter Market (B3, former BM&FBovespa), covering 20 years.

The research justification is given to the extent that its results contribute to a substantial segment of society, as advocated by Jordão *et al.* (2014). In this sense, the research contribution is threefold. First, the contemporary managerial, economic, political and social relevance of the theme is highlighted by Li *et al.* (2021), Xu and Liu (2020); Lee and Wong (2019), Nadeem *et al.* (2019); and Pedro *et al.* (2018), who noted the vital importance of measuring IC as a means of promoting the competitiveness, innovation, sustainability, wealth and performance of organizations. A recent study by Ocean Tomo (2021), for example, has confirmed that intangible assets accounted for 17% of the market value of the S&P500 in 1975, rising to 68% in 1995, 84% in 2015 and reaching more than 90% in 2020. In this sense, research on the subject becomes paramount. Second, this research offers impactful theoretical contributions, reducing the aforementioned gap and broadening the understanding of the theme from a long-term (historical) perspective – an unexplored issue in the literature. Additionally, the proposal originally applied and validated expands on the existing theory, offering a set of indicators for dimensioning the IC's contribution in long-term corporate results.

Third, significant implications for management practice are also highlighted, elucidating the role of IC as an element of business differentiation from the perspective of the firm's performance, competitive strategy and value, providing a competitive benchmarking process for a wide range of stakeholders interested in assessing EFP from a long-term holistic perspective, also offering contributions to the theories of shareholders and

sustainable management. These issues gain special prominence in the scope of the finance-based theory because the EFP and VC of organizations are the most critical factors for decision-making by stakeholders (Sudarsanam *et al.*, 2008), challenging economic and financial management in identifying techniques and tools to compare and differentiate companies and their industries over time.

This paper is organized into six sections. The second section discusses the relationship between IC, performance measurement and the creation of organizational value. The third section presents the research methodology. The empirical results of the study are presented and analyzed in the fourth section and discussed in the fifth section. The sixth section presents the conclusions, main limitations of the study and avenues for future research.

Previous studies and research hypotheses development

Although the study of IC has gained significant momentum in recent years, and its importance has grown since the early 1990s, the issue is not new (Dumay *et al.*, 2020). The first systematic study on the subject dates back to 1891, and the first legal mention of the theme was many centuries ago (Martins, 1972).

IC is the collection of intangible resources, knowledge, experience and intellectual property that an organization, community, country or society has and uses for creating value (Dumay, 2020; Jordão *et al.*, 2020). According to Ilyn (2014), IC has been associated with the difference in the market and book value which the financial market assigns to the intangible quality of management, professional practices, patented software, licenses, know-how and so on. The level of IC is what differentiates companies from each other. The quality and efficiency of IC usage enhance the profitability of a firm. Therefore, in the view of Aljuboori *et al.* (2022), the IC components are the most important sources of value, and IC as a whole is the main enabler of VC, above all of sustainable value. Accordingly, companies need to reconnect with the long-term perspective, avoiding the disproportioned focus on shareholder value and seeking to meet the expectations of a broad range of stakeholders.

Ferenhof *et al.* (2015) identified 83 models that could contribute to correct dimensioning and adequate management of the IC. According to Edvinsson *et al.* (2021), 20 years ago the measurement of IC was at an early stage of development, and since then, numerous academics and professionals have been seeking to find approaches that best represent the nature, value and reflexes of IC in organizations. In the view of Ferenhof *et al.* (2015), an explanation for the large number of models that emerged comes from divergent points of view of different interest groups or disciplines, or because of the focus on strategy or measurement. The first focus is concerned with optimizing the management of knowledge resources in the company to improve its performance. The second turns to standards, accounting and/or measurement of IC in monetary terms. However, these authors emphasize that despite the number of works developed in this direction, an important obstacle was detected: the lack of a common language. In this sense, efforts still need to be made to better understand the subject, because as companies depend more on knowledge, the process of identifying, managing, evaluating and measuring the IC tends to become more and more significant.

In the view of Salvioni and Gennari (2017), the globalization of markets and information channels has generated a growing competition between companies, changing the premises for business success, which increasingly depends on the capacity to maximize performance and create shared value for all stakeholders in the long-term rather than the short-term. From a more critical perspective, Dumay *et al.* (2020) realized that knowledge on the IC has been advanced beyond its original strategic focus on measuring, managing and reporting IC,

and now encompassing how IC impacts and is impacted by complex and increasingly knowledge-intensive institutions, economies, governments and societies.

According to [Nadeem et al. \(2019\)](#), despite the great importance attributed to IC in recent decades, its measurement and management are still elusive issues, mainly because of previous inadequate IC measurement models. However, the difficulties surrounding the measurement and recognition of IC as a sustainable influencer for generating EFP and value for companies over time had already been recognized by [Martins \(1972\)](#) in the 1970s.

Despite these difficulties, the international literature has presented several studies on the IC measurement over the years, shedding light on its influence on competitiveness, EFP and organizational VC ([Bontis, 2000](#); [Xu and Liu, 2020](#); [Edvinsson and Malone, 1997](#); [González et al., 2017](#); [Roos and Roos, 1997](#); [Sveiby, 1997](#)), and IC has been pointed out as the main driver of innovation ([Xu and Liu, 2020](#); [Grajkowska, 2011](#); [Subramaniam and Youndt, 2005](#)), providing expectations of sustainable future results ([Edvinsson et al., 2021](#); [Aljuboori et al., 2022](#)). Considering the above, the following research hypothesis will be empirically tested:

H1. IC contributed positively to sustainable EFP and VC over time in the companies listed on B3.

IC has been indicated as a determinant of the performance of organizations, regions and/or countries, although its influence is not linear, depending on contextual and socio-environmental factors ([Pedro et al., 2018](#)). IC is also recognized by the market through the expectation of generating future results ([Grajkowska, 2011](#); [Bontis, 2000](#)). The relationships between IC's constituent elements generate sustainable competitive differentials, resulting in improvements in organizational EFP and VC. Authors such as [Grajkowska \(2011\)](#), [Subramaniam and Youndt \(2005\)](#); [Tseng and Goo \(2005\)](#); and [Wang and Chang \(2005\)](#) advocated quantitative models for measuring IC based on indicators of EFP and VC. [Salehi et al. \(2014\)](#) analyze the relationship between IC, capital efficiency and economic value added (EVA) in 39 companies listed on the Tehran Stock Exchange, observing a significant relationship between IC, corporate performance and EVA.

[Xu and Liu \(2020\)](#) examine the impact of IC and its components on the performance of Korean companies. Based on the modified value added intellectual coefficient model, involving profitability, productivity, and market value, they observed that physical capital was the most influential factor, followed by human capital. Structural capital had no significant impact on the company's performance, and both innovation capital and relational capital detracted from the company's profitability.

[Li et al. \(2021\)](#) observed that while employed capital efficiency and human capital efficiency have a significant positive impact on a firm's performance, structural and relational capital efficiency are not related to this. Only the latter impacts on the creation of value for innovative companies but the other aspects of IC do not.

The results of [Aljuboori et al. \(2022\)](#) confirm the relationship between IC and company performance, stressing that this relationship was strengthened by the mediation of innovation capacity – which was fundamental in generating greater competitive advantages for the analyzed Malaysian small- and medium-sized enterprises.

In the Brazilian context, [Jordão and Almeida \(2017\)](#) analyzed the relationship between IC and the long-term EFP of 227 Brazilian companies and their respective industries over 10 years, concluding that the more intangible-intensive companies and industries tend to present better profitability and corporate returns over the years. Therefore, the following research hypothesis will be empirically tested:

H2. The most intangible-intensive companies presented EFP and generation of value superior to the others.

Taken together, the results of these researches many times showed the contribution of IC in generating competitive advantages, in sustainability and innovation, in organizational and financial performance and in generating wealth for organizations and stakeholders. More than that, they suggest that investments in IC can produce differentials that, in addition to improving performance indicators and organizational value, provide expectations of sustainable future results over time.

Research methodology

This research is classified as a quantitative, descriptive and applied study (Cooper and Schindler, 2006). According to Kayo (2002), this approach allows the measurement and analysis of the economic and financial companies' characteristics subject to empirical tests and is the most adequate to understand the effects of IC on the EFP and VC of listed companies. Furthermore, following Mangioni and McKerchar (2013), the use of a multiplicity of methods simultaneously allows for a triangulation that draws on the strengths of one method and, at the same time, minimizes the inherent weaknesses of another, making it possible to obtain meaningful and more holistic conclusions.

The conceptual basis has been supported by the works of Jordão and Almeida (2017); Tseng and Goo (2005), Kayo (2002); and Sveiby (1997), which are based on the formation of an index (IC-INDEX) derived from the ratio of the market value (MV) and the book value (BV). IC is evaluated by the market-to-book ratio, as proposed by Sveiby (1997), that is, $IC-INDEX = MV/BV$. The companies' MV was computed by multiplying the average annual MV of the assets/companies by the number of their shares, while the BV was obtained directly from the financial statements (FS). Thus, the IC-INDEX expresses the ability of the organization's IC to support long-term EFP and VC. When the MV/BV ratio is greater than 1 ($M/B > 1$) the organization is more likely to generate EFP and VC in a sustainable (long-term) manner.

This approach indicates that the IC's value can be expressed as the outcome of the difference between the economic value (market valuation) and the book value (net assets) of the companies, in line with Dumay *et al.* (2020), Ilyn (2014); and Edvinsson and Malone (1997). Contemporary literature fully recognizes that this method is among the most discussed and used in academia and in the market – which gives us a broad knowledge of its potentials and limitations.

Unlike component methods, i.e. those that divide the IC into components, measuring each component and aggregating their value, the method proposed in this research provides a more holistic assessment of the IC. Holistic methods evaluate the IC from the market value generated by it, bypassing the main limitations of component methods, considering:

- the impossibility of capturing many aspects of components that are not measurable accurately; and
- the impossibility of assessing the value of interactions between IC components, as the focus is on the measurement of individual components in line with Jardon and Martinez-Cobas (2021).

Moreover, given that this method is predominantly based on established accounting rules, it is, therefore, more transparent, comparable and reliable than alternative methods (Forte *et al.*, 2019). Added to these benefits, is the fact that this study considers a historical

perspective covering a long period of analysis (four periods of five years, making a total of 20 years) – which helps us to overcome market distortions.

According to [Berk et al. \(2015\)](#), the selected performance indicators are suitable, considering the gross margin (GM), the net profit margin (NPM) and the earnings before interest, taxes, depreciation and amortization (EBITDA) margin to assess profitability. The return on invested capital (ROIC), return on equity (ROE) and return on assets (ROA) were used to evaluate the corporate return. Finally, the EVA (computed by multiplying the cost of capital by the difference between ROIC and the weighted average cost of capital), the market value added (MVA) (corresponding to the difference between the MV and the capital invested in the company) and Tobin's Q (obtained from the ratio between a company's MV and the replacement value of its physical assets) were used as VC measures.

The empirical tests were based on data extracted from the FS and the *Econômica* system of the B3 listed companies in June 2021, considering all industries transversally. B3 is a stock exchange located in São Paulo, Brazil, and was created in March 2017 by the merger of BMF&Bovespa (São Paulo Stock, Commodities and Futures Exchange) and CETIP (Securities Custody and Financial Settlement Center). At the time of data collection, B3 was one of the five largest stock exchanges (financial and capital markets) in the world, with a net worth of more than \$13bn. The period 1995–2014 was selected because it encompasses a period of vitality in the Brazilian economy. The choice of this period considered a historical perspective with consolidated data and facts, and whose data could be compared in the same currency. Thus, in this study, the so-called “Real Plan” establishes the time horizon and the parameters to define the target population, as it introduced a strong currency in the Brazilian market, allowing the comparability of data over the years while avoiding potential distortions caused by the political-economic crises that began thereafter which could distort the results of the analysis and the conclusions of the study, following Gomes and Cruz's, (2020) recommendations. The focus on that period also supports a reliable assessment of the impact of IC on EFP and VC, as the IC's effect on company performance can be inconsistent during periods of market instability. Furthermore, [Bornemann et al. \(2021\)](#) point out that, although various elements and methods have been published over time, the IC still requires an integrated approach to illustrate its long-term impact on different organizations, emphasizing the value of historical analysis, having themselves made use of a period of 20 years in their studies. All companies listed on B3 from 1995 to 2014 were analyzed, comprising 393 companies from all industries. Those with registered common shares were selected, making a total of 387 companies, of which 184 (or 1,286 observations) presented valid data for the IC INDEX, profitability (EBITDA, NPM and GM), corporate return (ROIC, ROA and ROE) and VC (EVA, MVA and Tobin's Q). Thus, these 184 companies comprise the sample for the development of this study. The modeling of nonparametric data was applied to this sample, according to [Perez and Famá \(2006\)](#) and [Jordão and Almeida \(2017\)](#), in which the IC-INDEX variable was the basis for the initial segregation of companies into portfolios: 1,037 observations concerning companies with IC INDEX > 1 and 249 observations concerning companies with IC-INDEX < 1. The research process encompassed the two research hypotheses *H1* and *H2* presented throughout the theoretical explanation.

Different levels of analysis were applied to test the research hypotheses, including descriptive statistics, Spearman's correlation ρ and the analysis of time series for the entire period of 20 years and the four subsamples, covering periods of five years (1995–1999; 2000–2004; 2005–2009; and 2010–2014), as well as the Mann–Whitney U test, which is recommended to analyze nonparametric data ([Siegel, 1971](#)). The Kruskal–Wallis tests (quartile analysis and graphic analysis) were performed to test the research hypotheses. Before that, however, the

tests recommended by Wooldridge (2010) were still applied to verify potential problems of heteroscedasticity and endogeneity. To check whether the variance was constant, the Breusch–Pagan test was used – which is based on chi-square statistics and which has the null hypothesis test, that the error variances are equal, homoscedastic, and the alternative hypothesis is that error variances are heteroscedastic. In the present case, the problems verified were solved, transforming the data into a logarithmic base, having added a constant to eliminate the need to suppress some negative values. Once these procedures were carried out, any problems of heteroscedasticity and endogeneity of the data were circumvented. Moreover, internal (comparison of information derived from different sources of evidence) and external (comparison with the literature) triangulation was performed (cf. Jordão, 2015) as a way to overcome the limitations of the research, increasing the reliability of results and the validity of the study, in line with classical assumptions of Jick (1979). In this way, the information from the different tests was analyzed in the light of the literature, seeking to confirm, complement or contradict the previous empirical results. Moreover, the measures proposed by Mangioni and McKerchar (2013) were followed to strengthen the validity and reliability of the research. Finally, the procedures suggested by George and Bennett (2005) for data analysis were followed, hoping that the research has included all possible levels of investigation to provide relevant and consistent information, theoretically grounded, and that was within the context of the investigation.

Presentation and analysis of the results

In an attempt to account for the contribution of IC to EFP and VC in the B3 listed companies, an initial analysis comprised of the set of descriptive statistics presented in Table 1 was performed. By contrasting the average values of the group of companies with IC-INDEX > 1 with those of IC-INDEX < 1, significant differences were found between those groups in terms of EFP indexes (profitability and corporate return) and VC. According to Siegel (1971), the analysis of the median is the best measure for samples with unbalanced data, i.e. with a different number of observations over the years. The analysis of the median shows that there was greater profitability (EBITDA, NPM and GM), superior corporate return (ROIC, ROA and ROE) and higher VC (EVA, MVA and Tobin's Q) in the most intangible-intensive

Measures	IC-INDEX > 1 (n = 1,037)			IC-INDEX < 1 (n = 249)		
	Mean	SD	Median	Mean	SD	Median
<i>Profitability</i>						
EBITDA	1,988,815	6,806,111	394,464	623,988	1,805,189	83,608
NPM	9.37	106,3	9.54	−254.00	3,322.00	3.00
GM	38.65	22.24	34.07	29.60	65.54	24.89
<i>Corporate return</i>						
ROIC	10.75	22.66	8.40	−3.40	36.24	3.25
ROA	0.18	2.39	0.10	0.02	0.23	0.06
ROE	0.54	16.71	0.14	0.12	1.26	0.05
<i>Value creation</i>						
EVA	−308,961	2,451,279	−38,94	−1,808,188	6,293,258	−190,382
MVA	1.488,91	31,077,283	164,738	−6,733,95	19,561,018	−708,172
Tobin's Q	1.15	1.20	0.78	0.38	0.35	0.32

Source: Own elaboration. Based on research data. SD = standard deviation

Table 1.
Analysis of EFP and
value generation in
the period 1995–2004
– descriptive
statistics

companies, that is, those companies whose amplitude, structure and solidity of the IC make them more capable of generating sustainable (long-term) EFP and VC.

Table 2 presents the results of the Spearman ρ correlation based on the nonparametric data of the 184 companies, showing the relationship of IC with profitability, corporate return and VC of these companies, covering the entire period of 20 years (1995–2014) and the corresponding subsamples encompassing five-year cross sections (1995–1999; 2000–2004; 2005–2009; and 2010–2014). These results are related to the second level of analysis in this research.

It is important to mention that the Spearman correlation ρ measures the intensity of the relationship between variables (Cohen, 1988) in portfolios with IC greater (less) than one, but not the direction in which the variables are aligned. In this sense, the assessment of IC's contribution to profitability, corporate return and VC needs to be investigated in light of the literature. Analysis of the results reveals a positive contribution of IC to EFP, in terms of profitability and corporate return, as well as to VC throughout the period between 1995 and 2014, corroborating and expanding the theoretical premises of Edvinsson and Malone (1997) and Sveiby (1997) and the empirical findings of Andreeva and Garanina (2016) and Jordão and Almeida (2017).

The results shown in Table 2 indicate high statistical significance for 20 years and statistical significance for all cross sections of five years, emphasizing the existence of adequate parameters in the analysis of the influence of IC on all profitability (EBITDA, NPM and GM), corporate return (ROIC, ROA and ROE) and VC (EVA, MVA and Tobin's Q) indexes. In addition, the results confirm the aforementioned contribution of IC in all subsamples, except for the profitability indicators of EBITDA and NPM in the period (1995–1999), GM in the period (2000–2004) and EBITDA in the period (2005–2009). These results complement and expand the findings of Jordão and Almeida (2017), as this study, as well as covering 20 years divided into four subsamples of five years, also included indicators of VC, alongside the usual EFP indicators.

In Table 3, the analysis of the median was expanded to all four 5-year subsamples (1995–1999; 2000–2004; 2005–2009; and 2010–2014) to simultaneously examine the behavior of the data in four distinct and complementary long-term periods. As the economic and EFP of some companies in the sample changed over the 20 years, it was observed that when dividing the total sample into four periods of five years, the median of some of the companies showed different results within the subsamples when compared to the global sample. Thus, 87 companies interchanged between groups (G1 – comprising the companies with IC-INDEX > 1 and G2 – comprising the companies with IC-INDEX < 1) in each of the subsamples. This is understood as a normal process within the scope of the present study, not impairing its results and conclusions, as the analysis based on the results of the 20 years was combined with analyses that comprised five-year cross sections, which made it possible to capture the condition of each company at a given time.

As mentioned, the decision to focus the analysis on the post-Real Plan period sought to reflect the first decades of economic stability in Brazil, considering that previous years of hyperinflation made the analysis unfeasible. Besides, the subsamples were arranged to minimize other possible limitations related to the sample size and the mentioned time-cut period. A more detailed view of the phenomenon with the segregation of time series resulted in the following configuration: 20 companies in the period from 1995 to 1999 (10 with IC-INDEX > 1 and another 10 companies with IC-INDEX < 1), 34 companies in the period from 2000 to 2004 (23 with IC-INDEX > 1 and another 11 companies with IC-INDEX < 1), 127 companies in the period from 2005 to 2009 (98 with IC-INDEX > 1 and another 29 companies with IC-INDEX < 1) and 177 companies in the period from 2010 to 2014 (128 with IC-

Period	Indicators	Profitability			Corporate return			Value creation		
		EBITDA	NPM	GM	ROIC	ROA	ROE	EVA	MVA	Tobin's Q
1995–2014 Sample	Correlation coefficient	0.077	0.231	0.250	0.500	0.481	0.475	0.472	0.738	0.773
	Significance	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1995–1999 Subsample 1	Correlation coefficient	0.082	0.156	0.385	0.483	0.336	0.470	0.420	0.764	0.848
	Significance	0.605	0.325	0.012	0.001	0.030	0.002	0.001	0.000	0.000
2000–2004 Subsample 2	Correlation coefficient	0.202	0.237	−0.149	0.608	0.455	0.591	0.473	0.772	0.854
	Significance	0.055	0.024	0.158	0.000	0.000	0.000	0.000	0.000	0.000
2005–2009 Subsample 3	Correlation coefficient	0.098	0.111	0.219	0.325	0.299	0.365	0.347	0.724	0.775
	Significance	0.081	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2010–2014 Subsample 4	Correlation coefficient	0.083	0.315	0.336	0.596	0.619	0.535	0.511	0.728	0.774
	Significance	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Sources: Own elaboration; Based on research data

Table 2.
Spearman's ρ
correlation between
IC, EFP and value of
the companies listed
on the B3

Table 3.
Results of Mann–Whitney U test – contribution of IC on EFP and VC of Brazilian companies (over time)

TEMPORAL SERIES ANALYSIS																				
Period	1995–2014 (Sample)				1995–1999 (Subsample 1)				2000–2004 (Subsample 2)				2005–2009 (Subsample 3)				2010–2014 (Subsample 4)			
Indicator	G	N	Median	p	G	N	Median	p	G	N	Median	p	G	N	Median	p	G	N	Median	p
EBITDA	G11,037	G2 249	394,464	0.000	G1 29	G2 27	667,732	0.256	G1 76	G2 33	1,335,867	0.013	G1 309	G2 66	302,065	0.000	G1 536	G2 210	399,030	0.000
	G11,037	G2 249	83,608	9.54	G1 29	G2 27	698,566	12.06	G1 76	G2 33	836,006	13.09	G1 309	G2 66	68,543	10.41	G1 536	G2 210	85,153	9.18
NPM	G11,037	G2 249	279	0.000	G1 29	G2 27	1450	0.126	G1 76	G2 33	9.45	0.172	G1 309	G2 66	5.36	0.001	G1 536	G2 210	0.2	0.000
	G11,037	G2 249	34.07	0.000	G1 29	G2 27	36.01	0.059	G1 76	G2 33	42.97	0.077	G1 309	G2 66	34.16	0.023	G1 536	G2 210	32.55	0.000
GM	G2 249	G2 249	24.89	0.000	G2 27	G2 27	39.59	0.059	G2 33	G2 33	54.27	0.077	G2 66	G2 66	29.59	0.000	G2 210	G2 210	22.625	0.000
	G11,037	G2 249	8.4	0.000	G1 29	G2 27	6.13	0.007	G1 76	G2 33	12.795	0.000	G1 309	G2 66	9.83	0.000	G1 536	G2 210	8.4	0.000
ROIC	G2 249	G2 249	3.25	0.000	G2 27	G2 27	2.66	0.007	G2 33	G2 33	5.04	0.000	G2 66	G2 66	3.04	0.000	G2 210	G2 210	2.725	0.000
	G11,037	G2 249	0.0980	0.000	G1 29	G2 27	0.083	0.202	G1 76	G2 33	0.134	0.001	G1 309	G2 66	0.109	0.000	G1 536	G2 210	0.097	0.000
ROA	G2 249	G2 249	0.057	0.000	G2 27	G2 27	0.078	0.078	G2 33	G2 33	0.082	0.000	G2 66	G2 66	0.068	0.000	G2 210	G2 210	0.047	0.000
	G11,037	G2 249	0.1380	0.000	G1 29	G2 27	0.097	0.155	G1 76	G2 33	0.20	0.000	G1 309	G2 66	0.16	0.000	G1 536	G2 210	0.137	0.000
ROE	G2 249	G2 249	0.049	0.000	G2 27	G2 27	0.095	0.095	G2 33	G2 33	0.07	0.000	G2 66	G2 66	0.093	0.000	G2 210	G2 210	0.031	0.000
	G11,037	G2 249	–38,940	0.000	G1 29	G2 27	–238,969	0.006	G1 76	G2 33	–84,689	0.000	G1 309	G2 66	–29,158	0.000	G1 536	G2 210	–29,528	0.000
EVA	G2 249	G2 249	–190,382	0.000	G2 27	G2 27	–2,231,799	0.006	G2 33	G2 33	–784,296	0.000	G2 66	G2 66	–86,437	0.000	G2 210	G2 210	–185,008	0.000
	G11,037	G2 249	164,738	0.000	G1 29	G2 27	627,806	0.000	G1 76	G2 33	298,514	0.000	G1 309	G2 66	472,415	0.000	G1 536	G2 210	266,075	0.000
MVA	G2 249	G2 249	708,172	0.000	G2 27	G2 27	–3,832,223	0.000	G2 33	G2 33	–2,814,874	0.000	G2 66	G2 66	–458,486	0.000	G2 210	G2 210	–913,840	0.000
	G11,037	G2 249	0.7820	0.000	G1 29	G2 27	0.872	0.000	G1 76	G2 33	0.749	0.000	G1 309	G2 66	0.919	0.000	G1 536	G2 210	0.84	0.000
Tobin's Q	G11,037	G2 249	0.318	0.000	G1 29	G2 27	0.228	0.228	G2 33	G2 33	0.286	0.286	G2 66	G2 66	0.402	0.402	G2 210	G2 210	0.29	0.29

Notes: G – groups; G1 – group of companies with IC-INDEX > 1; G2 – group of companies with IC-INDEX < 1; p – p-value

Source: Own elaboration. Based on research data

Notes: G – groups; G1 – group of companies with IC-INDEX > 1; G2 – group of companies with IC-INDEX < 1; p – p-value
Source: Own elaboration. Based on research data

INDEX > 1 and 49 with IC-INDEX < 1). Thus, in this third level of analysis, the relationship between IC and profitability, corporate return and VC of companies over the years was examined through the study of time series to ascertain whether the aforementioned effects of IC are maintained sustainably over the years.

The results of the time series analysis (based on the Mann–Whitney U test) presented in Table 3 show the contribution of IC to EFP (profitability and corporate return) and VC of Brazilian companies, considering the global 20-year period and all five-year periods, revealing that this effect remains sustainable over time, expanding what is known about the topic, whether in the Brazilian context (Jordão and Almeida, 2017; Perez and Famá, 2006; Kayo, 2002) or the international context (Li *et al.*, 2021; Asiaei *et al.*, 2018).

Furthermore, these results shed light on the question posed by Andreeva and Garanina (2016) that not all outcome indicators matter in IC analysis. The findings of this research complement the evidence observed by Jordão and Almeida (2017) and Perez and Famá (2006) about the influence of IC on the EFP of companies and industries. The results also confirm IC's contribution to VC, corroborating and expanding the works of González *et al.* (2017); Salehi *et al.* (2014); and Grajkowska (2011) by revealing that the effects of IC on the different metrics of profitability, corporate return and VC occur simultaneously and systematically over the years. This suggests that IC is related to the establishment of competitive differentials (Salehi *et al.*, 2014) from the perspective of the results attained.

Seeking even greater robustness and depth for the results, in the fourth level of analysis it was investigated whether the most intangible-intensive B3 companies present higher profitability, corporate return and VC than the others – based on the Kruskal–Wallis test presented graphically in Figure 1. The aggregate result of the 1,286 observations per variable showed that this was the case for all the analyzed indicators (Graph 1) over the 20 years, except for EBTIDA, which presented a less linear behavior in the second quartile. In general, it was observed that companies in the fourth quartile (Q4) have higher profitability, corporate return, and VC indicators than those in the third quartile (Q3); the companies in Q3 presented indicators superior to those of the second quartile (Q2); and the companies in Q2 presented indicators superior to those of the first quartile (Q1). It is important to recall that Q1 was composed of companies with IC-INDEX < 1 (i.e. nonintangible-intensive companies); Q2 of companies with $1.61 > \text{IC-INDEX} > 1$ (i.e. low intangible-intensive companies); Q3 of companies with $2.91 > \text{IC-INDEX} > 1.61$ (i.e. intangible-intensive companies); and Q4 of companies with IC-INDEX > 2.91 (i.e. more intangible-intensive companies). Q1, Q2, Q3 and Q4 were composed of 43, 50, 37 and 54 companies, respectively.

Visual perception of the impact of IC on these variables in a global and segregated way reveals that intangible-intensive companies (from Q2 to Q4 with IC-INDEX > 1) present higher indicators of profitability (EBITDA, NPM and GM), profitability (ROIC, ROA and ROE) and organizational value (EVA, MVA and Tobin's Q) than the nonintangible intensive ones (those of Q1 with an IC-INDEX < 1). Similarly, the analysis of Figure 1 also reveals superior results in most periods in the indicators of the group of the most intangible intensive companies (Q3 and Q4) concerning the two least intensive (Q1 and Q2). There was a curious and paradoxical result about the companies with IC-INDEX > 1 in the period from 1995 to 1999 as nonintangible-intensive companies (Q1) presented two higher profitability indicators (NPM and GM) and one indicator of VC (EVA) than the others (Q2, Q3 and Q4).

Similar behavior was observed for the EBITDA variable in the less intangible-intensive companies (Q2), which presented more expressive indicators than the more intangible-intensive ones (Q3 and Q4) in all periods, corroborating the findings of Jordão and Almeida (2017). However, the most intangible-intensive companies have superior performance in the corporate return (ROIC, ROA and ROE) and VC (EVA, MVA and Tobin Q) indicators over

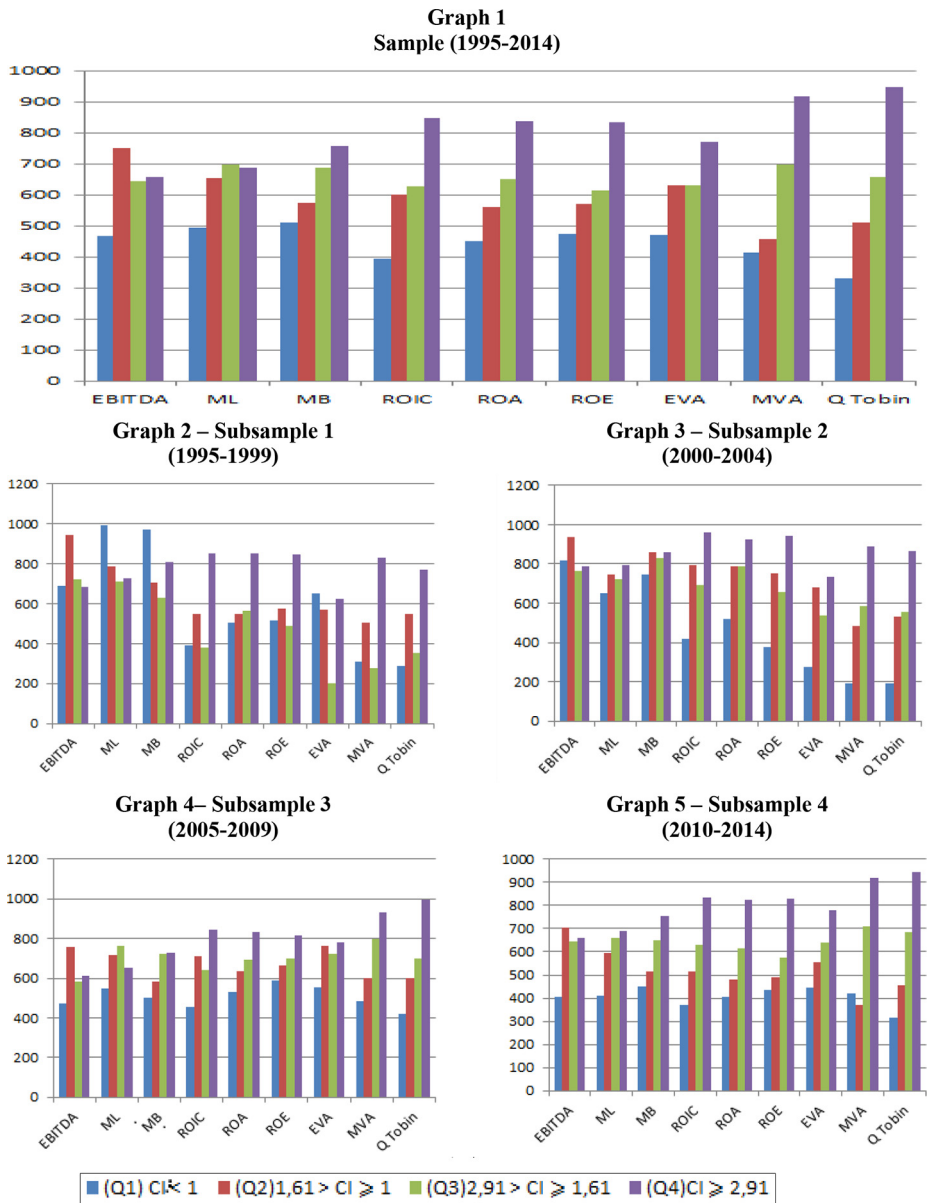


Figure 1.
Results of the
Kruskal–Wallis test –
contribution of IC on
EFP and VC of
Brazilian companies
(over time)

the global period and the four cross sections. These findings expand the theoretical understanding of Bontis (2000), Edvinsson and Malone (1997); and Sveiby (1997), and expand on the findings of Li *et al.* (2021), Tseng and Goo (2005); and Kayo (2002), by revealing that more intangible-intensive companies have higher profitability, corporate return and organizational value.

Hypotheses testing and discussion of the results

The set of results presented above increases the understanding of the importance of IC in establishing sustainable competitive differentials of companies, especially demonstrating the role of this asset in the EFP and VC of companies, revealing that IC can effectively be considered the main mechanism that enables the generation of results and the distinction between the company and its competitors, as pointed out by [Grajkowska \(2011\)](#), [Subramaniam and Youndt \(2005\)](#); [Tseng and Goo \(2005\)](#), [Wang and Chang \(2005\)](#); and [Sveiby \(1997\)](#).

Analysis of the results allows *H1* to be confirmed by revealing that the contribution of IC is sustainable over time in the companies listed in B3. The triangulation between the results of the time series analysis (Mann–Whitney U test) with those obtained in the Kruskal–Wallis analysis confirmed the contribution of IC – measured by different metrics for profitability, corporate return and VC – systematically over time. *H2* was also validated (except for NPM and GM in the period 1995–1999) as it was found that the most intangible-intensive companies present superior EFP and VC ability than the less intensive. The triangulation between the results of the descriptive statistics, the Spearman correlation ρ and the Kruskal–Wallis analysis revealed that there is a direct relationship between IC and the organizational results, showing that the intangibility is directly related to the company's performance.

Overall, these results corroborate and complement accounting and finance theory ([González et al., 2017](#); [Jordão and Almeida, 2017](#); [Andreeva and Garanina, 2016](#); [Asiaei and Jusoh, 2015](#)) regarding the need for and relevance of measuring the IC's value ([Nadeem et al., 2019](#)), as well as the recognition and reporting of intangible assets in companies' FS. From the perspective of finance and economics, the results of this research expand on the results of previous studies, such as [Wang and Chang \(2005\)](#), who found that IC directly affects the EFP of Taiwanese information technology companies; [Kayo \(2002\)](#), who noticed the influence of IC on the return indicators (of total capital and ROE) by contrasting Brazilian and North American companies; [Perez and Famá \(2006\)](#), who proved the impact of the degree of intangibility on return and value generation of Brazilian nonfinancial companies with shares traded on US stock exchanges; or [Xu and Liu \(2020\)](#), who confirmed the influence of IC on the EFP of companies.

The set of results also expands the knowledge regarding the sustainable perspective by certifying that IC is a relevant element in explaining not only the generation of financial results and value but also the longevity and sustainability of companies over the years. This is achieved through the IC measurement proposal applied and validated in this study, which includes long-term (historical) value generation measures (EVA, MVA and Tobin's Q) from an unexplored perspective, especially in emerging markets. The observed results confirm and complement the classical theoretical premises of authors such as [Martins \(1972\)](#) and [Hendriksen and Van Breda \(1999\)](#), or previous studies of [Bontis \(2000\)](#) and [Dumay and Guthrie \(2017\)](#), who considered that the disclosure of intangible assets by accounting can increase its information capacity and, at the same time, signal the prospects of performance and financial value of companies to the market. This statement gains even more relevance when we consider that all the metrics used in this research were based exclusively on publicly disclosed accounting information, which in the view of [Cornell et al. \(2017\)](#) is vital information in financial and capital markets, decisively influencing the pricing of shares and the choices made by stock analysts, bringing contributions to accounting and finance theorists and practitioners. These issues are even more relevant in the context of crises. Recent studies such as [Hong et al. \(2021\)](#) have shown that the crisis caused by the COVID-19

pandemic was associated with market inefficiencies, also inducing income and wealth inequalities among market participants.

Taken together, the results reveal that most intangible-intensive companies tend to display greater sustainable EFP (profitability and corporate return) and VC than the less intangible-intensive, expanding the theory of economics and management. Despite the lower correlation between IC and profitability in some cases, robust results were found for corporate return and VC in all companies and all periods of the sample. These results can be explained by the theory of finance, considering the irrelevance of dividends due to high returns and the prevalence of value generation over profitability, in line with [Weston and Brigham \(1979\)](#). In fact, as the paradigmatic propositions of [Modigliani and Miller \(1958\)](#), which form the basis of modern finance theory, many criticisms have been made of this work, especially because the theory they propose ignores important realities, as capital markets are not perfect, compromising its practical utility. These issues have important legal and economic implications, especially for scholars within the field of the relationship between law and finance. More than revealing that profitability was less relevant than corporate returns (which offers the real measure of return on investment to shareholders) and the generation of value (which is the main objective of economic and financial management), the results observed in this research offer a new avenue for future investigations by linking the financial economics theory to the managerial theory of IC. These findings are even more important considering that the sample comprised companies from all industries and that these results were observed not only in the global sample covering the 20 years but also in all cross-sectional sections of five years.

Analyzing the contributions to society, it is clear that the proposal developed in this study offers a tool that allows comparisons between companies, industries and sectors, ensuring a better view of the relationship of IC with economic-financial performance and generation of value over time. This tool, complemented with other indicators, can also provide strategic guidelines for managers in making decisions to increase the competitiveness of companies. These contributions are expanded due to the relevance of IC to the economy, society and governments, in line with [Pedro *et al.* \(2018\)](#), [Nadeem *et al.* \(2019\)](#); and [Xu and Liu \(2020\)](#). The modern theory of finance recommends that financial management aims to create value and wealth for shareholders, as advocated by [Behera \(2020\)](#). At the same time, the international literature ([Galankashi *et al.*, 2020](#); [Geng *et al.*, 2021](#)) maintains that various efforts have been made to develop performance assessment tools that can and should be effectively used to compare of organizational results of companies and industries in a holistic and sustainable view, also considering that this is a central topic in financial analysis in developed and developing economies.

The study supports the establishment of specific criteria for analyzing companies and industries, supporting the selection of portfolios by investors, analysts, managers and other actors involved in important strategic and financial decisions based on high standards of corporate governance. Such issues have been prominent in the contemporary literature of law, economics, finance and accounting. Even so, the results gathered bring contributions to theorists and practitioners in all these areas. [Cornell *et al.* \(2017, p. 325\)](#), for example, found the close relationship between the quality of accounting information, company valuation and investor sentiment by emphasizing that “one of the most significant empirical findings of the behavioral finance literature is that investor sentiment affects asset prices.” [Black *et al.* \(2020\)](#) realized that well-built and country-specific corporate governance indexes and high governance standards (with robust boards of directors), supported by the disclosure of accounting and financial information, help to predict the higher market value of companies in emerging markets. The results of these authors suggested that regulators and investors

would do well to focus on these issues when assessing governance, as would company managers when responding to investor pressure for better governance. In terms of implications for managerial and finance theory and practice, it should also be mentioned that IC's contribution to EFP and sustainable VC in companies helps to clarify, to some extent, why expectations for future results are reflected in stock prices on the stock exchanges. Based on the Brazilian experience, these results help to explain the gap between the market value and the book value observed by IC scholars ([Andreeva and Garanina, 2016](#); [Grajkowska, 2011](#); [Tseng and Goo, 2005](#); [Roos and Roos, 1997](#)), expanding legal, economic, financial and managerial understanding on the topic, elucidating the role of IC as an element of business differentiation (from the perspective of the results attained). These issues are highlighted by the international literature ([Xu and Liu, 2020](#); [Nadeem et al., 2019](#); [Jordão and Almeida, 2017](#)), which emphasizes that the study of IC and its measurement are one of the most challenging and complex areas in the field of finance, accounting, law and economics, whether in theoretical or practical terms. In addition, the contributions to the practice of management are also accentuated as entrepreneurs and organizations from emerging markets, especially in Latin America, have been looking for ways and alternatives to evaluate their results in search of greater sustainability, health and longevity, as observed by [Gupta et al. \(2019\)](#).

This does not preclude recognizing, as the literature does, that holistic methods and that the more quantitative frameworks and approaches used to measure IC to date are not fully satisfactory. Holistic methods are criticized because they assume that all the value of the company over book value is due to the IC. Also, this method identifies the monetary value of IC with the value generated by IC and other types of capital in the company, in line with [Jardon and Martinez-Cobas \(2021\)](#). Quantitative measures are useful to illustrate the financial value of intangible assets and can be more easily used for comparisons between companies, characteristics that tend to catch the attention of managers, investors and other interested parties. However, intangible assets are hard to quantify even with access to all due data, and quantitative measures regularly illustrate only fractions of the full complexity of intangibles and fall short of delivering a comprehensive picture, leading, depending on assumptions, to incomplete interpretations and/or contradicting conclusions ([Alwert et al., 2009](#)).

This aspect is not to say that the measurement of IC is inherently flawed or that it creates more confusion than it is worth. The message that all the models, frameworks, discussions and literature appear to be conveying is that IC is interesting, is complex and complicated, it needs to be understood better and needs to have a diverse set of tools for its management and measurement dependent on the purpose of the measurements, in accordance to [Dumay \(2009\)](#). Qualitative measures are generally much more perceptive and may be used to "evaluate," in the sense that they can highlight the attributes of IC that are not quantifiable. Above all, are based on the present and the future – as opposed to quantitative measures that are retrospective and tell us what happened – and they tell us what's going on ([Verbano and Crema, 2013](#)), providing a supplementary expression of the IC to those who intend to assess the company's ability to create sustainable value in the future.

In fact, Professor Edvinsson, one of the forerunners of the modern IC approach, in a recent study with his colleagues, reviewed the evolution of IC research over the last 20 years. [Edvinsson et al. \(2021\)](#) found that the knowledge economy represents a consolidated concept today and a new paradigm is emerging. The authors conclude that organizations are using new business models to create value that also involves a sustainable perspective – this being the integration of IC with sustainability a central issue for scholars and practitioners of management, economics and business – an aspect widely studied and debated in this article.

The results of this study expand the understanding of the role of IC in obtaining competitive advantages and sustainable results (in terms of EFP and VC) in emerging markets, corroborating and expanding the recent findings of [Xu and Liu \(2020\)](#), which focused only on the manufacturing industry in a shorter period. This study, however, goes further because it is historical, multisectoral, and long-term, also representing a valuable platform for the sustainable development of different industries in the so-called information and knowledge economy. Following [Dumay et al. \(2020\)](#), the results suggest that researchers on the topic can now investigate critical nonfinancial issues that may be relevant to a diversity of stakeholders for internal management and external responsibility.

The historical perspective that this work contemplates brings additional benefits to the theory by presenting consolidated results in a known context and free from speculative or other short-term effects. Besides, these results help to critically assess and understand how the measurement, management and disclosure of financial information and the use of IC by companies affect the way people and society organize and value these companies and their connections. Still, according to [Dumay et al. \(2020\)](#), the results of this study can help in the creation of guidelines, standards and indexes to measure, manage and report IC, allowing, in practice, the proposition of new regulations, new business models, new products and services, new technologies and new structures.

Finally, it is worth noting that the original model for measuring the influence of IC on EFP has been tested and validated. This complements what is known about the subject and provides improvements to economic and management theory and practice, revealing that the inclusion of the VC metrics is proved to be a valid and consistent alternative for evaluating long-term results. Although many of these variables had already been studied before, they have not been studied in an aggregated way or over such extended periods. Moreover, from the research findings, it is clear that most intangible-intensive companies and industries tend to generate superior results than the others. Therefore, it is expected that scholars and professionals can make use of the proposal adopted to visualize these relationships – which offers a complementary tool to traditional financial analysis and portfolio selection, increasing the inference capacity of managers and representing a significant result for business practice, especially when considering that investments in knowledge assets that form IC tend to generate results that last over the years.

Conclusions

Despite the great importance of IC, the challenge of measuring it represents one of the most complex areas in the field of finance, accounting and economics, both in theoretical and practical terms, mainly because IC is often considered as a hidden (intangible) asset that does not appear in companies' FS. In this sense, the challenge of understanding the extent to which IC influences EFP and value generation in a sustainable perspective is yet to be examined in-depth, especially in emerging economies.

The results expand on the previous literature, especially considering:

- the innovation of the IC measurement approach and its effects;
- the depth of the tests applied, using three indicators to assess the contribution of IC to profitability (EBITDA, NPM and GM), three for profitability (ROIC, ROA and ROE) and three others for the generation of value (EVA, MVA and Tobin's Q);
- the context in which the tests were carried out, because of the lack of studies in economies such as Brazil – the tests may be replicated in other emerging and/or more mature markets; and

- the 20 years (1995–2014), broken down into four different five-year subsamples. This allowed an unprecedented historical and long-term view of EFP and VC, with a consolidated perspective exempt from speculative movements in the financial and capital markets, especially in emerging markets. In this sense, the conclusions indicate that
- IC positively influences profitability, corporate return and organizational value sustainably;
- the most intangible-intensive Brazilian companies listed in B3 presented more robust results than the less intangible-intensive; and
- IC truly contributes increasing sustainable EFP and VC over time.

The results revealed the importance of measuring the effects of knowledge (tacit and explicit) materialized in IC in the development of sustainable competitive differentials through the prism of the results of the companies over time. IC proved to be a relevant organizational element to explain the generation of wealth, improving not only the competitiveness but also the perpetuity and sustainability of the companies over the 20 years of this research. These findings offer a “path” and a tool for evaluating and measuring IC and its relationship with profitability, corporate return and the generation of organizational value. In this sense, the research helped to value IC and its effects on corporate results – a matter of growing importance in a knowledge-based economy, in which IC represents the companies’ main asset, making use of it to survive, grow and develop.

Overall, the results observed here are in line with the aforementioned premises, offering contributions to professionals and researchers in the area. The results of the tests carried out within the scope of this study expand the understanding of the impact of IC on corporate outcomes measured by different metrics (EBITDA, NPM and GM for profitability, ROIC, ROA and ROE for corporate return, and EVA, MVA and Tobin’s Q for VC). The use of different metrics to measure the diverse components of corporate outcomes has the advantage of minimizing the impacts of the limitations inherent to each metric. The research findings allow us to conclude that:

- companies that are intangible-intensive have more significant results than nonintangible-intensive companies; and
- the most intangible-intensive companies present superior sustainable EFP (in terms of profitability and corporate return) and greater capacity to create value, meaning that there is a close relationship between the degree of intangibility and the organizational outcomes.

It was also possible to conclude that these impacts on outcomes remain over time, which explicitly evidences that IC impacts the performance and organizational value in the long term. In this sense, it can be concluded that IC unequivocally contributed positively to the sustainable EFP and VC in Brazilian companies listed on B3.

No research is exempt from limitations. In this opportunity, it is worth mentioning that the main limitation of this study was the use of only one variable, the IC-INDEX, for measuring the IC’s value. This issue, in turn, does not diminish the importance, nor the contributions or the impact of this research. Quite the contrary, it points out. The proposal reveals a simple and objective way, well-grounded in theory, to measure the value of IC and its contributions to corporate results in a sustainable perspective.

A disadvantage that is usually pointed out in this type of research is the reference to the market value at a specific time. Another issue is that market value can also be affected by

external, mainly social or economic factors – which could affect the valuation of companies or the IC. This research sought to overcome both limitations by adopting a historical and longitudinal perspective and circumscribing the research conclusions and eventual digressions considering the investigated context. Although any measure used to scale the IC and its consequences may be criticized, the essential thing is to realize that the theoretical, practical and managerial utility of this proposal can offer a complementary tool to traditional performance analysis or along with other quantitative and qualitative measures. Despite the inherent limitations, the proposal now tested and validated supports the verification of relationships that are maintained over time, allowing analysts, investors, managers, economists and entrepreneurs to use it as a means of comparing companies and industries based on a widely recognized and used indicator.

In addition, the methodology used opens up several avenues for future economic and management research and practice, especially in the field of financial valuation and performance measurement. In this sense, it is expected that other studies, in emerging or developed economies, in specific or multisectoral industries, individually or compared, or using other metrics for assessing or measuring the IC's value in addition to that already used here, can be carried out. Similarly, it would be useful to include other indicators and/or quantitative or qualitative variables, including control variables, or to use other proxies for the IC construct in parallel with the metrics used in this research. So, it is expected that more than confirming the robustness of this proposal in other contexts, it will be possible to expand the understanding of the topic in this very important area of knowledge and still so lacking objective measures to assess the real effects of the knowledge materialized in the IC on the EFP and VC over the years – as proposed, tested and confirmed in this paper. Moreover, it is expected that this proposal can serve as a reference for new academic works and applied studies. These issues gain special prominence from the perspective of finance-based theory because EFP and VC of organizations have been critical factors in the decision-making of different stakeholders, challenging managers, accountants and economists in proposing techniques for financial analysis that allow comparisons and differentiation between companies and their industries over time.

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