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Intangible assets evaluation: systematic and scientific validation at Itaipu Technological Park – PTI Brazil

Osni Hoss

Universidade Federal do Paraná, Curitiba-PR, Brazil.

hoss@utfpr.edu.br

Edited by:
Orleans Silva Martins
Paulo Roberto da Cunha

Abstract

Objective: This research aims to systematize the evaluation of intangible assets, which serve as a subsidy in the decision-making process in the value management of companies, while the problem that this research aims to answer is how to evaluate companies with a focus on intangible assets.
Method: The method used was the deductive one. The survey-type technique was also used for direct questioning of people, supported by Delphi, brainstorming and data mining. The protocol defined for the research was: overview of the methodology objectives, and issues; field procedures (access to the locations of information sources and formation of a competence cell); evaluation questions. Descriptive statistical analysis tools were applied regarding information about the central tendency and variability of intangible asset valuation.
Results: One of the knowledge gaps overcome in this research was the construction of a systematic for valuing intangible assets in non-profit entities such as the Itaipu Technological Park - PTI. The results reveal where and when wealth was generated, showing what and how much, serving as a management tool to add value in non-profit organizations.
Contributions: The main contribution was the systematization of the valuation of intangible assets not registered by traditional accounting, for non-profit organizations, allowing to reveal wealth created by the organization, in qualitative and quantitative terms, for the maintainers, investors and for society. Another finding is the failure of models that evaluate intangible assets as book-to-market, since there is an error in the premise in the two variables of the formula.

Keywords: Intangible assets, evaluation, value added.

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Introduction

Strategic information produced in a competitive intelligence system is useful in the decision-making process of organizations. Right decisions contribute to building wealth and adding value. Intangible assets have diverse nomenclatures, such as invisible, intangible assets, intellectual capital, human, structural, goodwill, super profits. In the present research, the following nomenclature will be used: intangible assets, such as goods that do not have immediate physical representation, like software, patents franchises and trademarks (Brooking, 2010; Sveiby, 1998; Kaplan & Norton, 1997; Lev, 2001).

Tangible values are managed by widely used tools such as: Discounted Cash Flow, Free Cash Flow, Payback, Internal Rate of Return, Average Cost and Marginal Weighted Capital, Economic Value Added, Net Present Value of the Aggregate Market (Sousa, 2007; Copeland et al., 2002; Weygandt et al., 1990).

Intangible assets in turn are approached by tools whose approach is eminently qualitative, such as construction of intangible assets as a business strategy by Brooking (2010); Intangible Asset Monitor, Sveiby (1998); Balanced Scorecard by Kaplan and Norton (1997). While in the quantitative approach the work of Baruch Lev and his research and work entitled Knowledge Capital Earnings, Lev (2001) can be highlighted.

Given this context, Zanoteli et al. (2015) puts in question the current model of recognition, measurement, and disclosure, it is necessary to evaluate the valuation of intangible assets, the celebration of processes such as the Banker et al. (2019), Amir et al. (2003) which shows that the capital market does not recognize the value of intangible assets, in the financial statements following accounting rules (CPC, 2020). Thus, the problem with this research is how to evaluate intangible assets in organizations, for the purpose of using information in the business decision-making process.

Gaps identified in the literature that motivate this study refer to book-to-market models that do not record the real value of companies. Also, most of the value of companies is based on intangible assets and not in traditional accounting. Intangible asset measurement models based on intellectual capital scores are primarily qualitative. As well as models that directly identify intellectual capital, which do not show the interdependent relationship of intangible assets, Kaplan and Norton (1997); Sveiby (1998); Lev (2001); Copeland et al. (2002); Zanoteli et al. (2015); Amir et al. (2003). Thus, this study crosses the frontier of knowledge with the systematization of the valuation of intangible assets, presenting the qualitative and quantitative components of value, as well as defining the calculation procedures for intangible assets, as shown in Table 1.

Table 1: Research Outline

Theoretical Support	Frontiers of knowledge - Gap left	Transposition of the frontiers of knowledge with systematization of intangible assets – Topic 4 and 5
Direct identification of intellectual capital	Does not show the interdependent relationship of intangible assets and despise the influence of market factors.	Development of systematic Valuation of Intangible Assets – VIA (4) and scientific validation (5) with the components quantitative value of investments on intangible assets: Intangible Adjusted Result – IAR (4.1 and 5.1); Canvass of Intangible Value – CIV (4.2 and 5.2), and qualitative variables: Canvass of Intangible Coefficient – CIC (4.3 and 5.3), which uses that impact on quantitative variables. Determination of procedures for calculating intangible assets, considers the strengths of existing theoretical models and influence of market factors.
Difference between book and market value	It is based on two false assumptions: that accounting records the actual value of assets and that the market is correct quantification. So, the gap left when it comes to real quantification of companies.	
Return on tangible assets	Is based on the return on tangible assets, thus disregards the intangibles that can represent most of the value of companies.	
Intellectual Capital Scores	It is based solely on qualitative aspects which affect their ability to contribute to the management and wealth creation process.	

Table 1 illustrates and describes the knowledge frontier transposition on the valuation of intangible assets. At its top, it presents the use of theoretical tools to identify the gaps left and serve as theoretical support for the construction of the proposed systematization. The testing and validation of systematization was done at Itaipu Technological Park.

2 Theoretical Support

Intangible values were first used in the sixteenth century in a judicial decision, in 1884 about growth of intangible assets. Moonitz and Jordan (1963) wrote about measurement, in 2001 Lev and in 2010 Hoss et al., published their works about evaluation of intangible assets. Intangible assets can add competitive advantages to companies, like in the case of a brand. Authors such as Sveiby (1998) and Stewart (1998), Karagiannis et al. (2009), Pike (2009), Pretorius (2009) and Buonomo et al. (2020), consider as such the human capital, the structural and relationship capital, belonging to a company, whose valuation is given by the difference between the amount presented by accounting and the market, explained by the formula:

I = MV - BV

Where: I = Intangible Value; MV = Market value; BV = Book Value

To evaluate these assets, it is relevant to group them, as it can be visualized in models such as the Balanced Scorecard,

by Kaplan and Norton (1997) that uses Finances, Customers, Internal Processes, Learning and Growth. Monitor of Intangible Assets (Sveiby, 1998, 2020) with Customers, Organizational, Intellectual and Human. Lev (2001) with Innovation, Mark, Structure and Monopolies. The groupings seek a balance between external indicators, aimed at the shareholder and clients, and the internal indicators, referring to the critical business processes, innovation, learning and growth.
How can corporate performance be measured? This may be a question with many facets. Performance is commonly seen as segmented. A department in charge of quality may be capable of continuous improvement as a strong indicator of performance measurement, and a director of human resources can be taken by the passion to measure intellectual capital to obtain a good measure of the ability to develop products, processes, and markets. Correia and Lucena (2021) point out that governance requires reports with adequate internal practices, especially for the survival of companies operating in competitive markets.

An accountant can ultimately be attracted to the quantitative evaluation of the past to ascertain whether the company is competitively healthy. A chief financial officer - CFO can have a penchant for designing numerical results and a trend curve. A bank almost always considers the latest balance sheet to aid the decision on whether to lend money or not, which can foster the growth of a business. There is even the simple ability to execute a recovery procedure, directly to the borrower or guarantor, for owning tangible property valued in excess of the borrowed capital plus interest and costs of law. However, each of these perspectives of conventional analysis, with all its merits, has won due respect by the experience of application and has, over many years, contributed to the analysis of the possibilities of business success (Brooking, 2010; Sveiby, 1998; Kaplan & Norton, 1997; Lev, 2001).

Specifically, regarding credit, the method also includes the 5 Cs of credit, which make the analyst look at the history of the character who is asking for his or her financial obligations to be met, the capability to repay the debt, which demonstrates the borrower's capital strength, and capital side, which refers to the available collateral, and the current economic and industry conditions that may affect the relationship between the borrower and lender (Amir & Sougiannis, 2003).

There are numerous ways to evaluate corporate performance, but there will always be gaps between one form and another. Some methods can be complementary, making the analysis more complex, but with the advantage of being wider and more varied, but not always more reliable. Martins (2001), show various models of business valuation, based on goodwill, the algebraic sum of assets and liabilities in the stock market, profit, discounted or free cash flows, the economic value added, summarized in Table 2.

Table 2: Company Valuation Models. Adapted from: (Martins, 2001)

Model	Variables - Objectives
Accounting Asset Valuation	Based on the sum of the required assets and liabilities measured in accordance with accounting principles.
Equity Valuation by Market	It consists of measuring the number of required assets and liabilities based on the fair value of its specific items.
Present value of dividends	The action of a company value can be calculated based on the future dividend stream.
Based on the market value of similar stocks	It consists in comparing the company with others that have similar characteristics (economic sector, technological, managerial profile).
Profits capitalization	Of the weighted average profits before interest and taxes and capitalizes them with the use of a subjectively determined rate.
Multiple Billing	Simplistic version of profits capitalization model. The net income is replaced by the company's revenues.
Cash Flow multiples	It is determined and combined with the multiplier, resulting in an estimated value for the company. Earnings before interest, income taxes, depreciation, depletion and amortization (EBITDA).
Based on EVA	It is the net operating profit minus the opportunity cost of all capital employed.
Discounted Cash Flow	As an indicator of wealth generation capacity, cash flow is evidence of the expected efficiency of certain businesses, overcoming some difficulties in accounting profit.
Free Cash Flow	It is generated after deduction of taxes, permanent investments and expected variations in working capital, the amount available to suppliers.
MVA	Market Value Added.
CAPM	Capital Asset Pricing Model.
APM	Risk-free rate of return.

Table 2 shows the models that are based on cash flow, economic factors, and the stock market. It presents the main variables of these, as well as observations about them. Kayo (2002) and Kayo et al. (2006) used to evaluate Intangible Assets Lifecycle concepts in conjunction with Economic Value Added (EVA) and Market Value Added (MVA). Assessment procedures aimed at valuing companies should consider strategies, knowledge of organizations and establish a scalable and flexible deployment process.
Martins (2001), point out the five main variables that must be observed in the process of valuation of companies: relevant cash flow; period of projection; perpetual or residual value; conditions of financial indebtedness; discount rate. For Sousa (2007) it comprises three steps: cash flows, application of valuation techniques and selection of viable alternatives. For Damodaran (2020), there are four possible approaches: discounted cash flows; in which the assets are valued at acquisition cost; relative, which estimates based on the prices of other comparable assets; the contingency, which uses price option models to measure the value of assets, called the real options model.
The study published on intangible assets by Lev (2000) pointed out determinant factors of organizational wealth

conception, such as: brand and innovation, in addition to the growing importance of the value added by organizations from 1900 to 1999 and consequently its increasing valuation and its significance in the competitive advantage aspect for the organizations. In addition, companies become increasingly active agents in the market for mergers, acquisitions, and ancillary operations, such as: restructuring, repurchases of shares financing, and investments. Copeland et al. (2002) argue that increasing shareholder importance in most developed countries has led an increasing number of managers to focus on creating value for business.

Too much analysis can lead to lethargy and paralysis in the process of analyzing an organization. Sometimes, simplicity can mean a lot in advance and eliminate variables that do not serve the main purpose, or at least that do not have characteristics that make them relevant to the measurement process (Lev, 2001). So, a good measure, seeking to remove the extras and include what is necessary to provide security and assertiveness, is the proposal for procedures for the determination of intangible assets.

The conventional analysis presents a real contribution to the process of organizational assessment, in terms of economic and financial performance, for comparison purposes with other companies. In relation to CPC-15, it is recognized that the recognition of intangible assets occurs from the acquisition date, where the acquirer must recognize separately from the goodwill for expected future profitability (goodwill), the identifiable assets acquired, the liabilities assumed and any non-controlling interests in the acquisition (CPC 2020b). However, it does not include intangible assets missing from the balance sheet, which consequently distort the intended outcome of the analysis. So, the valuation of intangible assets is presented with significant advantages in identifying the drivers of intangible assets and measuring them, serving as a benchmark for performance analysis, value added production and free cash.

3 Methodological Procedures

The method used was the deductive one (Marconi & Lakatos, 2017). The type of exploratory research was used (Hoss, 2021). The survey-type technique was also used for direct questioning of people, supported by Delphi, brainstorming and the data mining technique (Cooper & Schindler, 2016; Ceron et al., 2020). The theoretical-conceptual support (topic 2) is bibliographic research (Hoss, 2021). The systematic process (topic 4) was performed in the post-doctoral program under the guidance of Prof. Almir Ferreira de Sousa, contributions of Prof. Claudio A. Rojo and Prof. Dimas Detoni. The approach of this research is managerial.

The scientific validation was developed in section 5 of this article with the aim of validating the proposed systematization with the following protocol (Yin, 2005): overview of the methodology, objectives and issues; field procedures (access to the locations of information sources and formation of a competence cell); evaluation questions (application of the systematic developed in topic 4); guide for reporting the study (using the tool developed in topic 4 and then presenting the results obtained topic 5. Also, a competency unit was created consisting of Jessica Yuki de Lima Mito, Pamela Suelyn Passarini, Silvana Gomes, Nelinho Davi Graef, Jonhey Nazario Lucizani to research the value-adding variables, also serving as an ethics and management committee for the evaluation process with participation in the evaluation of 230 people linked to the PTI.

Descriptive statistical analysis tools were applied regarding information about the central tendency and variability of values found: IAR, CIV, VIA. The following variables were used as measures of association in the systematization and analysis of intangible asset valuation: Value of Intangible Assets (VIA), classified as research object, Intangible Adjusted Result (IAR), Canvass of Intangible Value (CIV), Canvass of Intangible Coefficient (CIC), classified as main component and free cash flow (FCF), opportunity cost (OC) as well as other existing variables in the subordinate organizational structure, classified as secondary components, as can be seen in Chart 1.

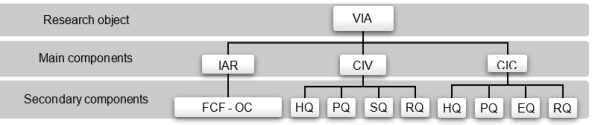


Chart 1: Systematic statistical association

where: HQ = Human Quadrant; PQ = Processes Quadrant; SQ = Structural Quadrant; RQ = Relational Quadrant.

The financial statements were projected at the exponential rate, using the parameter gross revenue, based on the first four years, with the following formulation: ((YEAR4 / YEAR1) ^ (1/4)) - 1, Graph 1,

Graph 1: Projection rate of financial statements

Graph 1 shows the projection rate. Topic 4 shows the systematic for the evaluation of intangible assets and then topic 5 presents the scientific validation.

4 Systematic Valuation of Intangible Assets

The premise of the systematic valuation of intangible assets is generation of wealth Hoss et al. (2010), also supported on authors such as Martins (2001) regarding cash flow, Lev (2001) regarding the generation of wealth in financial terms (Copeland et al., 2002) regarding the aggregation of economic value. Thus, following the systematic proposed in this paper, the valuation is given by:

VIA = (IAR + CIV) × (1 + CIC)
Where: VIA = Value of Intangible Assets; IAR = Intangible Adjusted Result; CIV = Canvass of Intangible Value; CIC = Canvass of Intangible Coefficient.

The proposed formula is based on the ability to generate wealth by corporations that must accrue an aggregation of income above the cost of capital. The pillars of the formula are: adjusted income generated by corporations named as IAR, the first component of the formula performed at topic 4.1; and the investment in resources, conditions that favor accumulation of wealth, named as CIV that is the second component of the formula, performed at topic 4.2. In addition, the third pillar of support measures, named as CIC, is the qualitative aspect of the value generated by the company, performed at topic 4.3.

The systematic proposes the joining of the developed value-adding variables into quadrants Human, Processes, Structural and Relational (Crawford, 1994; Kaplan & Norton, 1997; Edvinson & Malone, 1998; Sveiby, 1998; Lev, 2001; Kayo, 2002; Smith & Parr, 2000). The systematic proposed by this research aims to focus the time series from the viewpoint of past–present and present-future (Lev, 2001). The variables are measured in quantitative and qualitative terms.

To complement the understanding of systematization, an illustration is presented below in Figure 1 of the proposed groupings and perspectives to be considered in addition to the series and how to treat the variables: both qualitative and quantitative. It illustrates the systematic measurement of intangible assets, in perspective, and shows the interrelationship existing in the processes. The heart of the staircase curve shows the relation of the variables, in the shape of a spiral involving the Human, Structural and Relational Processes quadrants in a continuous cycle. It also evidences the ratio of intangible assets in the form of quadrants and perspectives to consider – internal and external – as well as the focuses: past–present and present-future.

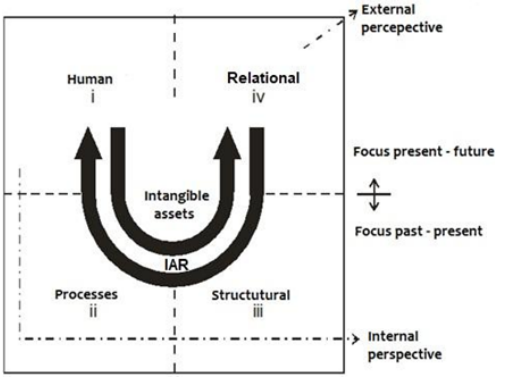


Figure 1: Proposed Systematics

Figure 1 also presents in its center the intangible assets that are produced by the interactivity between the quadrants, thus forming the Intangible Adjusted Result - IAR

The quadrants should be observed from two perspectives: internal and external. While the human and structural processes quadrants emphasize the internal perspective because we understand that the assets produced in these quarters are mainly internal, the quadrant perspective emphasizes the external environment, for offering goods and services to the market from which it receives a response, thus generating a continuous process of relationship between the company and the market.

The past–present focus is directed to the Structural and Processes quadrants. It is understood that to offer goods and services to the market, first it is necessary to form its structure and organize the business processes. So, with people's support, the organization can produce the services to offer to the market. The focus of the present future is on the Human and Relational quadrants. In addition to offering goods and services in the present, the company must provide competition and continuity in its operations. A generation component of intangible value is the potential for wealth creation that is strongly connected with both people and the market. Qualitative variables must be researched in each company with the aid of brainstorming, while quantitative variables must be researched in the organization's financial statements: qualitative variables are evaluated on a scale of 0 to 7 (table 3), thus producing a coefficient that will be used in the system presented for the determination of intangibles; quantitative variables – it is recommended to search the company's financial statements and investments in the previous three years, besides the current year, in addition to the investment plans for the next three years.

4.1 Calculation of the Intangible Adjusted Result - IAR

Martins (2001) states that the free cash flow looks interesting in the evaluation process. This research is calculated from the perspective of the company and determines the average value, so we adopt the free cash flow (FCF) which, according to Damodaran (2004), should be considered when evaluating, considering all the rights holders, such as: shareholders and lenders, that represent the cash provided by operations after investments. The FCF is the box that can be used to pay the providers of capital, which is cleared before the payment of debts principal, and interest. It is considered that the FCF, minus the opportunity cost, represents the aggregate wealth.

The proposed systematic is used to calculate the Intangible Adjusted Result (IAR) and the free cash flow, from which one must subtract the opportunity cost of the organization. For Copeland et al. (2002), this procedure allows the measurement of the aggregation of corporate value. The Intangible Adjusted Result (IAR) was calculated, according to the proposed systematization, as can be seen in the following formula.

$$IAR_{me}=(\sum^{7}_{i=1}FCF_{i})/7\ (\sum^{7}_{i}=1Tx.A/Ei)/7$$

Where: FCF = Free Cash Flow; *OC* = Opportunity Costs (Tx × A/Ei); Tx=Tax; A/E = Asset or Equity

Regarding the challenges of the first systematic variable, the middle Intangible Adjusted Result (IAR) represents the aggregation of wealth from the company's financial point of view. It was adopted based on the cost accounting profit to find the intangible. However, we identified the need to adjust the accounting profit due to a lack of accurately reflecting the wealth generated by the corporation, since it is related to legal requirements such as the principle of the transaction and the inadequate framework for investments in intangible assets expended, requiring adjustments to define its real value.

The Intangible Adjusted Result (IAR) applies a descriptive statistical analysis to identify the standard deviation of the period, i.e., 7 years. It is required to subtract one standard deviation of the IAR to find the minimum value for the IAR and add a standard deviation of the amount to find the upper limit of the IAR.

4.2 Canvass of Intangible Value - CIV

Regarding the component known as the calculation of the Canvass of Intangible Value (CIV), the financial amount invested or to be invested in intangible assets, past, present and future, is evaluated. These are financial resources invested in assets subject to assessment, such as: brands, investments in processes, computerized systems and related to customer acquisition, which are intangible assets in their essence, in their nature. The cost as a base is accepted because the value generated above it is identified in the other variables of the systematic proposed in this research.

For the statement of calculation of the CIV, we used quantitative research on the variables in the financial statements of the company. To investigate the investments made in the three previous years, the current year, and the investment plans for the next three years.

The definition of variables incorporates a qualitative aspect, regarding the choice of which variables will be the object of evaluation, but what is sought in this component of the formula VIA is measuring the quantitative factors assessed in the period y -3 to y +3, in assets intangible assets.

To calculate the CIV, (quadrants: Human, Processes, Structural and Relational), we used the following formula:

$$CIV_{me}=(\sum^{7}_{i=1}\ CIV(h+p+s+s)i)/7$$

After determining the CIV, the standard deviation of the CIV of the period evaluated should be calculated. Subtract one standard deviation to find the minimum value for the CIV and add a standard deviation to find the upper limit.

4.3 Canvass of Intangible Coefficient - CIC

This component of the proposed formulation represents the qualitative aspect that contributes to the measurement of value added. Regarding the definition of variables, there is a need to anchor them within a critical reasoning to identify the real contribution of the aggregation of wealth for the corporation.

In calculating the CIC, each evaluator assigns a value to all the selected variables, as in the scale proposed in Table 3.

Tabela 3: Likert scale for the evaluation of qualitative variables

Number of points	Response
7 (seven)	excellent
6 (six)	optimum
5 (five)	very good
4 (four)	good
3.5 (three and a half)	average (normal expected)
3 (three)	regular
2 (two)	weak
1 (one)	insufficient
0 (zero)	absent

Source: Adapted from Likert (1932)

Table 3 presents the scale to assess the qualitative variables. For each variable, we calculate the average. From the average, it is subtracted 3.5. known as the standard average, then multiplied by a factor of 0.071429, resulting in the amount sought. For each quadrant, all the values sought need to be added up. This refers to the defined variables' contribution to adding or destroying wealth for the organization, i.e., an evaluation resulting in an amount higher than the average 3.5 will create value added and it will be destroyed if the amount is lower. The factor 0.071429 was determined as follows: the systematization has 4 quadrants, each of which is surveyed, and the variables evaluated from 0 to 7 (with an average = 3.5). Starting from the goal of 100% allocates the 4 quarters, 25% each. Dividing 25 by 7 (maximum) results in 3.571429; subtracting the average (3.5) gives 0.071429. It is understood that the aggregation occurs to overcome the expected value.

For the Canvass of Intangible Coefficient – CIC, one must add the values found in the four quadrants, add 1 representing the multiplication base. To determine the coefficient intangible (CIC) the values found in the four quadrants should be added. Regarding the fourth element of the proposed formulation 1 + CIC is justified by the fact that the first number represents the amount multiplied by the quantity found by which CIC can add or destroy value.

This systematic component of the proposed systematic measures the perceived value of the corporation by the players and external to the corporation in an investigation of the aggregation of wealth. We analyze the business-to-business relation to assess the generation of wealth for the corporation, due to the internal association between all the participants in the business game as the suppliers, customers, and employees of the corporation for assessment. The purpose of investigating and assessing the real impact of these elements contributes to adding value to the corporation. Its essence is intangible.

The total value is obtained by adding the value of tangible assets to the amount obtained in the formula VIA, the tangible part of the amount revalued to market value and adjustments to the present time. The valuation of the company by its actual amount is of strategic importance because it allows support and assists managers in negotiating with lenders. It allows the identification of opportunities and threats to the business, as well as its strengths and weaknesses, contributing to the competitive success of the organization.

Aware that the science at this stage has left the field of certainty for the field of probability, as evidenced by the appropriate techniques, it is not aimed, therefore, to be absolutely sure, but to build a model that provides a range of values just as important to consider in the era of knowledge as the intangible assets.

5 Scientific validation at the Itaipu Technological Park (PTI)

PTI presents financial equilibrium and, for the analyzed period, presents no risk of continuity as well as it presents positive conditions for growth. As an organization with social aims, the profitability of invested capital must be confronted with the know-how and knowledge produced.

5.1 Calculation of the Intangible Adjusted Result – IAR

The Intangible Adjusted Result (IAR) was calculated, according to the proposed systematization, as can be seen in Table 4. The annual rate for opportunity cost was SELIC. Regarding the years 2017 to 2019, projections were made by the Central Bank of Brazil (BCB), indicating a Selic at 7.25% per year at the end of 2017; Remaining at the same level at the end of 2018, according to the Focus report released in August 2017.

The chosen rates, respectively 8.29%, 10.96, 13.47%, 14.18%, 7.25%, 7.25%, 7.25%, for this purpose, are justified due to the Institution's small size, that Brigham et al. (2016) suggest serious limitations for the use of Capital Asset Pricing Model (CAPM), in addition to the fact that it does not have shares evaluable in the open market. For the evaluation of the cost of capital, the Selic rate was adopted, the rate that accompanies inflation, with safer indicators, and which best represents the reality of PTI. Free Cash Flow (FCF) was calculated as the systematization, as can be seen in Table 4 (Damodaran, 2004, 2020).

Table 4: Free Cash Flow (FCF)

	1	2	3	4	5	6	7
Periods	2013	2014	2015	2016	2017	2018	2019
(=) EBITDA	5.009,75	3.122,77	11.135,62	4.401,28	4.643,35	4.875,51	5.094,91
(-) Investments	7.537,21	6.509,24	6.827,27	5.331,43	2.857,00	2.963,25	3.073,46
(=) FCF	(2.527,46)	(3.386,47)	4.308,35	(930,16)	1.786,35	1.912,26	2.021,45

In Table 5 Intangible Adjusted Result was calculated.

Table 5: Intangible Adjusted Result - IAR

i	1	2	3	4	5	6	7
Periods	2013	2014	2015	2016	2017	2018	2019
(+) FCF	(2.527,46)	(3.386,47)	4.308,35	(930,16)	1.786,35	1.912,26	2.021,45
(-) Opportunity Cost	2.647,89	3.959,68	5.998,85	6.482,84	3.414,01	3.516,43	3.621,92
(=) IAR	(5.175,35)	(7.346,15)	(1.690,50)	(7.413,00)	(1.627,66)	(1.604,17)	(1.600,47)
						Average	(3.779,62)
						Standard deviation	2.779,28
						IAR -s	(6.558,89)
						IARme	(3.779,62)
						IAR +s	(1.000,34)

Afterwards, the calculation (Tables 4 and 5) of the second component of the systematic proposal, Calculating Canvass of Intangible Value – CIV, was started.

5.2 Calculating Canvass of Intangible Value - CIV

The Canvass of Intangible Value (CIV) and the definition of the variables were obtained by data mining, supplemented through Brainstorming and Delphi techniques (Butler et al., 2000; Edvinsonn & Malone, 1998; Kaplan & Norton, 1997; Lev, 2017; Hoss, 2003; Hoss, 2010; Sousa et al., 2012; Hoss, 2015). For the calculation of the quantitative intangible value, realized and projected investments of the recommended period, shown in Tables 6, 7, 8, 9.

Table 6: Calculating Canvass of Intangible Value Human Quadrant CIV

Human Quadrant	1	2	3	4	5	6	7	Subtotal
Periods	2013	2014	2015	2016	2017	2018	2019	
Volunteer work	0	0	4.688.012	1.402.393	1.454.550	1.508.646	1.564.754	10.618.355
Human Resources	906.312	1.328.365	1.095.049	1.446.901	1.500.713	1.556.526	1.614.414	9.448.280
Education and Culture	1.661.638	2.384.611	2.277.995	2.433.256	2.523.751	2.617.612	2.714.963	16.613.826
Science, Technology	1.279.152	1.612.950	2.308.967	1.540.573	1.597.869	1.657.295	1.718.931	11.715.737
Socio Economic Development	105.940	249.650	175.124	27.633	28.661	29.727	30.832	647.567
(=) CIV (h)	3.953.042	5.575.575	10.545.148	6.850.757	7.105.543	7.369.805	7.643.895	49.043.765

In Table 7 Canvass of Intangible Value Process was calculated

Table 7: Calculating Canvass of Intangible Value Process Quadrant CIV

Process Quadrant	1	2	3	4	5	6	7	Subtotal
Periods	2013	2014	2015	2016	2017	2018	2019	
Purchasing and contracting	794.009	919.078	1.216.033	1.255.624	1.302.322	1.350.757	1.400.993	8.238.817
Accounting and Equity	582.485	542.369	803.411	1.141.662	1.184.122	1.228.160	1.273.837	6.756.045
Covenants	272.900	369.075	377.759	418.559	434.125	450.271	467.017	2.789.705
Financial and Budget	819.589	1.239.515	1.120.859	1.139.599	1.181.982	1.225.941	1.271.535	7.999.018
General Services and Logistics	2.142.168	1.711.564	2.920.403	4.515.946	4.683.899	4.858.097	5.038.775	25.870.852
Technology of Information	2.357.968	2.679.336	3.842.648	3.547.481	3.679.415	3.816.256	3.958.187	23.881.291
Science, Technology and Innovation	939.387	1.612.428	1.493.065	906.065	939.763	974.713	1.010.964	7.876.385
Project Management and Fundraising	279.378	520.560	393.569	278.927	289.301	300.060	311.220	2.373.016
Itaipu Tourist Complex	5.646.723	6.482.329	8.369.384	9.262.054	9.606.518	9.963.794	10.334.357	54.018.436
Communication Advisory	805.198	1.295.353	1.257.345	885.820	918.764	952.934	988.374	7.103.789
Corporate Development Advisory	436.602	735.543	663.168	465.753	483.074	501.040	519.675	3.804.855
Legal Advice	619.569	677.229	745.659	1.222.921	1.268.403	1.315.576	1.364.504	7.213.861
Board of Directors' Assistance	622.097	1.026.348	821.548	808.706	838.782	869.977	902.333	5.889.791
Internal Audit	0	0	292.926	367.413	381.077	395.250	409.950	1.846.615
Board of Directors	286.137	453.777	400.888	367.256	380.914	395.081	409.774	2.693.827
(=) CIV (p)	16.604.208	20.264.504	24.718.664	26.583.785	27.572.462	28.597.908	29.661.492	174.003.024

In Table 8 Canvass of Intangible Value Structural was calculated.

Table 8: Calculating Canvass of Intangible Value Structural Quadrant CIV

Structural Quadrant	1	2	3	4	5	6	7	Subtotal
Periods	2013	2014	2015	2016	2017	2018	2019	
Financial and Budget	65.983	91.923	112.893	76.959	79.822	82.790	85.869	596.240
Infrastructure and Works	2.556.732	3.594.853	3.950.344	3.373.073	3.498.520	3.628.634	3.763.586	24.365.742
Business Security Advisory	931.885	1.042.938	925.391	2.011.194	2.085.992	2.163.572	2.244.038	10.473.126
Itaipu Tourist Complex	1.772.977	1.878.181	2.634.355	3.058.784	3.172.543	3.290.533	3.412.911	17.447.308
Services and Logistics	775.462	646.121	1.466.662	1.198.749	1.243.332	1.289.573	1.337.533	7.957.432
Education and Culture	110.431	178.651	115.482	177450.43	184.050	190.895	197.995	1.154.954
Information security	-	-	-	6188.18	6.418	6.657	6.905	26.168
(=) CIV (s)	6.213.470	7.432.667	9.205.127	9.902.398	10.270.678	10.652.654	11.048.837	64.725.832

In Table 9 Canvass of Intangible Value Relational was calculated.

Table 9: Calculating Canvass of Intangible Value Relational Quadrant CIV

Relational Quadrant	1	2	3	4	5	6	7	Subtotal
Periods	2013	2014	2015	2016	2017	2018	2019	
Business generated	4.120.249	3.913.725	4.819.240	4.931.040	5.114.430	5.304.640	5.501.925	33.705.249
Unila University*	33.891.956	37.628.084	40.249.598	80.307.578	48.019.304	48.019.304	48.019.304	336.135.127
Unioeste University	432.455	648.683	648.683	504.531	288.303	299.026	310.147	3.131.827
Open University of Brazil	114.600	127.400	157.100	176.100	191.100	208.600	228.600	1.203.500
CIBiogás-ER	0	10.455.761	2.199.240	17.687.282	1.551.470	27.182.888	22.701.333	81.777.974
Itai	3.236.083	3.511.868	3.679.769	178.591	43.630	43.670	43.670	10.737.282
Iguaçu Space	109.000	480.596	385.041	598.911	578.818	499.972	374.979	3.027.317
Science, Technology ovation	11.666.709	14.863.253	14.873.682	20.084.584	20.831.549	21.606.294	22.409.853	126.335.923
Business development	571.757	730.778	687.725	1.023.130	1.061.182	1.100.648	1.141.582	6.316.802
Socio Economic Development	1.860.255	2.546.418	2.589.365	2.808.250	2.912.691	3.021.017	3.133.371	18.871.367
Project Management	0	0	18.062	24.584	25.499	26.447	27.431	122.023
Itaipu Tourist Complex	2.420.194	2.932.892	3.574.194	3.828.110	3.970.481	4.118.147	4.271.305	22.695.131
Education and Culture	1.246.803	1.545.423	2.211.565	1.567.359	1.625.651	1.686.111	1.748.819	11.631.729
(=) CIV(r)	59.670.060	79.384.880	76.093.263	133.720.051	86.214.108	113.116.764	109.912.319	658.111.445

In Table 10 were summarized Tables 6, 7, 8, 9.

Table 10: Calculating Canvass of Intangible Value CIV

	1	2	3	4	5	6	7	Subtotal
Periods	2013	2014	2015	2016	2017	2018	2019	
CIV(h)	3.953.042	5.575.575	10.545.148	6.850.757	7.105.543	7.369.805	7.643.895	49.043.765
CIV(p)	16.604.208	20.264.504	24.718.664	26.583.785	27.572.462	28.597.908	29.661.492	174.003.024
CIV(S)	6.213.470	7.432.667	9.205.127	9.902.398	10.270.678	10.652.654	11.048.837	64.725.832
CIV(r)	59.670.060	79.384.880	76.093.263	133.720.051	86.214.108	113.116.764	109.912.319	658.111.445
CIV	86.440.780	112.657.627	120.562.201	177.056.992	131.162.791	159.737.132	158.266.543	945.884.066
							Periods	7
							Average (in 1000)	135.126
							Standard Deviation (in 1000)	31.629
							CIV -s	103.497
							CIVme	135.126
							CIV +s	166.755

Table 10 shows CIV value. Afterwards, the Canvass of Intangible Coefficient - CIC was calculated.

5.3 Canvass of Intangible Coefficient- CIC

For the Canvass of Intangible Coefficient- CIC, which affects the organization's ability to provide structural conditions for the achievement of its activities and the quality perceived by stakeholders. Thus, the contributions of the interested parties regarding the creation of financial returns are considered. For the definition of the variables, we used directional anchors in literature and supported by the brainstorming and Delphi, data mining and survey techniques (Butler et al., 2000; Edvinsson & Malone, 1998; Kaplan & Norton, 1997; Lev, 2017; Hoss, 2003; Hoss, 2010; Sousa et al., 2012; Hoss, 2015).

According to the scheme proposed at topic 4.3, to calculate the CIC, the qualitative variables for each quadrant are determined. Each evaluator (230 people) assigned a grade for each variable according to the scale proposed in Table 3. The average of each variable (column a) from which the standard mean (column b) was subtracted resulting in the difference (Column c), then multiplied by the proposed factor (column d), obtaining the CIC value for the variable. The sum of the variables in each quadrant was performed. The evaluation was done with people who work in PTI directly and indirectly, as well as with the players involved, evidenced in Tables 11, 12, 13, 14 and the summary, that is the sum of the values found in the four quadrants, is shown in Table 15.

Table 11: Canvass of Intangible Coefficient - CIC(h)

Human Quadrant	Evaluation				Average	Standard	Difference	Factor	CIC
	1	2	...	230	(a)	(b)	(c=a-b)	(d)	(d = c x d)
Undergraduate courses offered at PTI	5	5	3	4	5,1340	3,5	1,633971	0,071429	0,116713
Postgraduate courses offered at PTI and/or supported by FPTI	4	6	5	4	5,3280	3,5	1,827957	0,071429	0,130569
Youth Education	5	6	5	5	5,6829	3,5	2,182927	0,071429	0,155924
Stimulus and promotion of scientific production and knowledge	6	5	4	5	5,3084	3,5	1,808411	0,071429	0,129173
Popularization of Science	7	5	5	6	5,5874	3,5	2,087379	0,071429	0,149099
Teacher training	-	4	4	-	5,3462	3,5	1,846154	0,071429	0,131869
Competences in research and development	6	6	5	4	5,2463	3,5	1,746305	0,071429	0,124737
Intra and inter-team participation and cooperation	4	5	3	3	4,6497	3,5	1,149746	0,071429	0,082125
Technical and administrative competence of FPTI teams	6	4	5	4	5,0936	3,5	1,593596	0,071429	0,113829
Entrepreneurial culture	6	6	5	3	4,8037	3,5	1,303738	0,071429	0,093125
Business competence	5	5	5	3	4,6173	3,5	1,117347	0,071429	0,079811
Motivation of PTI inhabitants	5	5	6	4	5,0952	3,5	1,595238	0,071429	0,113946
Degree of confidence in joint actions	3	6	4	4	5,1602	3,5	1,660194	0,071429	0,118586
Professional ethical conduct	4	6	4	4	5,5475	3,5	2,047511	0,071429	0,146252
CIC(h)									1,685758

In table 12, we calculated Canvass of Intangible Coefficient of processes quadrant.

Table 12: Canvass of Intangible Coefficient - CIC(p)

Processes Quadrant	Evaluation				Average	Stan-dard	Difference	Factor	CIC
	1	2	...	230	(a)	(b)	(c=a-b)	(d)	(d = c x d)
Strategic management	5	5	-	4	4,7727	3,5	1,272727	0,071429	0,0909096
PTI Governance	-	6	-	4	5,0055	3,5	1,505464	0,071429	0,1075338
People management focused on creativity and innovation	3	5	-	3	4,6497	3,5	1,149746	0,071429	0,0821252
Security	5	6	7	6	5,5982	3,5	2,098174	0,071429	0,1498704
Intra- and inter-institutional communication	4	5	6	4	4,8378	3,5	1,337838	0,071429	0,0955604
Institutional Policies	5	4	5	3	4,8205	3,5	1,320513	0,071429	0,0943229
Effectiveness of computerization and systematization	7	-	5	3	4,7816	3,5	1,281553	0,071429	0,0915401
Effectiveness of monitoring and control mechanisms	4	5	5	4	4,7151	3,5	1,215054	0,071429	0,0867901
Processes aimed at sustainability	5	6	-	-	4,9849	3,5	1,484925	0,071429	0,1060667
Support processes for product/service and business development	-	6	-	3	4,8442	3,5	1,344221	0,071429	0,0960164
Innovation management	-	5	-	3	4,8324	3,5	1,332432	0,071429	0,0951743

Fund-raising	-	5	-	3	4,8452	3,5	1,345238	0,071429	0,096089
Intellectual property support processes	-	6	-	3	4,9387	3,5	1,438650	0,071429	0,1027614
Knowledge management	-	6	-	3	4,8239	3,5	1,323864	0,071429	0,0945623
Project and business portfolio management	5	5	-	3	4,7289	3,5	1,228916	0,071429	0,0877802
CIC(p)									1,477103

In table 13, we calculated Canvass of the Intangible Coefficient of the structural quadrant.

Table 13: Canvass of Intangible Coefficient - CIC(s)

Structural Quadrant	Evaluation				Average	Standard	Difference	Factor	CIC
	1	2	...	230	(a)	(b)	(c=a-b)	(d)	(d = c x d)
PTI equipment, facilities and physical structure	7	5	6	5	5,8202	3,5	2,320175	0,071429	0,165728
Facilities, spaces and environments for learning and training	7	5	6	5	5,7130	3,5	2,213004	0,071429	0,158073
Infrastructure for work activities	7	5	6	5	5,4651	3,5	1,965116	0,071429	0,140366
Accessibility and mobility	4	6	6	4	5,3436	3,5	1,843612	0,071429	0,131687
Research and development infrastructure	-	6	6	5	5,4808	3,5	1,980769	0,071429	0,141484
Physical and electronic library collection	-	6	-	4	5,4900	3,5	1,990000	0,071429	0,142144
PTI environments encourage creativity and innovation	4	5	6	4	5,1802	3,5	1,680180	0,071429	0,120014
Information and Communication Technology Infrastructure	7	5	6	4	5,4575	3,5	1,957547	0,071429	0,139826
Maintenance and conservation of physical facilities	7	5	6	4	5,6549	3,5	2,154867	0,071429	0,153920
Maintenance and conservation of equipment	7	6	6	4	5,5586	3,5	2,058559	0,071429	0,147041
Structures and facilities aimed at sustainability	5	5	-	-	5,2200	3,5	1,720000	0,071429	0,122858
Security infrastructure	6	5	6	5	5,7466	3,5	2,246606	0,071429	0,160473
Spaces for cultural events and activities	7	6	6	5	5,6339	3,5	2,133929	0,071429	0,152424
Support services	6	6	6	4	5,0664	3,5	1,566372	0,071429	0,111884
Spaces for sports, leisure and coexistence	3	5	2	4	4,4151	3,5	0,915094	0,071429	0,065364
CIC (e)									2,053286

In table 14, we calculated the Canvas of Intangible Coefficient of relational quadrant.

Table 14: Canvass of Intangible Coefficient - CIC(r)

Relational Quadrant	Evaluation				Average	Standard	Difference	Factor	CIC
	1	2	...	230	(a)	(b)	(c=a-b)	(d)	(d = c x d)
Potential to establish professional relationship	6	6	6	4	5,5249	3,5	2,024887	0,071429	0,144636
Potential to establish institutional relationship	6	6	6	5	5,5830	3,5	2,082960	0,071429	0,148784
Development of technological solutions	-	6	-	4	5,0305	3,5	1,530457	0,071429	0,109319
Institutional image	6	7	6	5	5,6858	3,5	2,185841	0,071429	0,156132
Job and Income Opportunities	7	5	5	5	5,2629	3,5	1,762911	0,071429	0,125923
PTI Marketing	4	6	4	2	5,0372	3,5	1,537209	0,071429	0,109801
Knowledge about FPTI's vision, mission and values	5	6	4	5	5,2069	3,5	1,706897	0,071429	0,121922
Promotion of sustainable tourism	-	6	-	5	5,4878	3,5	1,987805	0,071429	0,141987
Dissemination of Science and Technology	-	6	-	4	5,1507	3,5	1,650685	0,071429	0,117907
Contribution to regional productive systems	-	-	-	4	5,3211	3,5	1,821053	0,071429	0,130076
Contribution to the regional innovation system	-	-	-	4	5,2487	3,5	1,748677	0,071429	0,124906
Contribute to public policies	-	-	-	4	5,1075	3,5	1,607527	0,071429	0,114824
Development of technical skills in the territory	-	-	-	4	5,4136	3,5	1,913613	0,071429	0,136687
Support for business and enterprise development	6	-	5	3	5,3687	3,5	1,868687	0,071429	0,133478
CIC(r)									1,816383
ACI (e)									2,053286

Tables 11, 12, 13, 14 show CIC values. The sum of the CIC was 8.032530, Table 15.

Table 15: Canvass of Intangible Coefficient- CIC (1 + CIC)

Canvassss of Intangible Coefficient	Coefficient
CIC(h) - Human Quadrant	1,685758
CIC(p) - Process Quadrant	1,477103
CIC(s) - Structural Quadrant	2,053286
CIC(r) - Relational Quadrant	1,816383
CIC (h + p + s + r)	7,032530
1 + CIC	8,032530

Table 15 shows the total of CIC value. Then it was found the value of intangible assets as proposed by VIA systematic by the formula VIA = (IAR + CIV) × (1 + CIC) in Table 16.

Table 16: Value of Intangible Assets

	IAR	CIV	Subtotal	1 + CIC	VIA
VAI -s	(6.558,89)	103.497,48	96.938,59	8,032530	778.662,14
VAI	(3.779,62)	135.126,30	131.346,68	8,032530	1.055.046,14
VAI +s	(1.000,34)	166.755,11	165.754,77	8,032530	1.331.430,15

In addition (table 16) to the value of intangible assets proceeded to the calculation of tangible amount to find out the actual amount that it is now. At this time, it revised up the whole process run, reaching the required accuracy.

5.4 Itaipu Technological Park Value

To complement the value of intangible assets, the tangible amount was calculated to discover the real value of PTI. At this moment, the entire process was reviewed, to arrive at the desired accuracy. The value of tangible assets adopted was the book value because it is in present values. You still have to be able to audit the values if it is used for external purposes, as is the case of borrowing, as it could be used, along with development agencies.

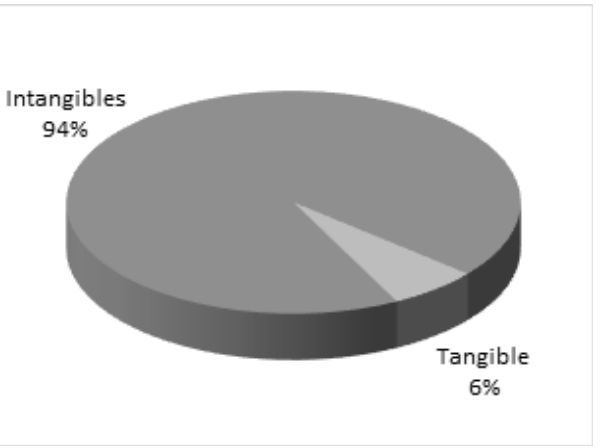
The value of the company was then calculated, as can be seen in Table 17.

Table 17: PTI Value

	Value of Intangible Assets	Tangible	Total
Value -s	778.662,14	72.092,96	850.755,10
Value	1.055.046,14	72.092,96	1.127.139,10
Value +s	1.331.430,15	72.092,96	1.403.523,11

Table 17 shows PTI value and the Graph 2 shows the value relation between tangible and intangible assets.

Graph 2: Value Relation of PTI



Graph 2 shows the ratio of Itaipu Technological Park value in percentage terms, with intangible assets accounting for ninety-four percent of the amount, while tangible assets represent six percent.

The calculated value of intangible assets is 23 times greater than the net equity determined by traditional accounting. Thus, it is possible to affirm that this evaluation process is necessary on a permanent basis, to identify where and when wealth is created in the organization, in addition to allowing the management of the largest portion of wealth created.

6 Conclusion and Recommendations

One of the knowledge gaps overcome in this research was the construction of a systematic for valuing intangible assets in non-profit entities such as the Itaipu Technological Park - PTI. The results reveal where and when wealth was generated, showing what and how much, serving as a management tool to add value in non-profit organizations.

A consequence of this study was to reveal the wealth and values created by the Itaipu Technological Park - PTI, allowing the maintainers/investors and managers to know and manage the assets that represent 94% of the organization's value. It also serves as a subsidy to show investors the results obtained by the resources invested. It contributes to the choice of the best management practices, as it allows knowing where and how intangible assets happen, a fact that traditional accounting does not reveal.

The problem with this research was how to evaluate intangible assets in organizations, for the purpose of using information in the business decision-making process. And the answer is the systematic valuation of intangible assets, as shown in topic 4. In this way, the objective that was to systematize the evaluation of intangible assets was accomplished by the formula VIA =

(IAR + CIV) × (1 + CIC) as shown in topic 4.

The main contribution was the systematization of the valuation of intangible assets not registered by traditional accounting, for non-profit organizations, allowing to reveal wealth created by the organization, in qualitative and quantitative terms, for the maintainers, investors and for society.

Another finding is the failure of the models that evaluate the value of intangible assets as the difference between market and accounting, book-to-market, since there is a premise error in the two variables of the formula: i) the market – it does not reflect the real value of the organization, as it incorporates imprecise factors, such as: shareholders' expectations and the interests of market agents; ii) the accounting uses the historical cost as the basis of value and the transaction principle in its records, consequently it does not reflect the real value of the assets.

The latent scientific findings, derived from the analysis of the theoretical tooling and the scientific validation performed at the Itaipu Technological Park, are: i) existence of an interrelated dependence on intangible assets due to its value being closely linked with the conditions necessary for the generation of wealth in terms of people, processes, structure and relational, as evidenced in figure 1; ii) a need to consider the wealth-generating capacity already produced by organizations, as well as to project and measure future generation potential; the need to consider quantitative and qualitative variables, as well as to transform them into monetary factors, as presented in the formula Value of Intangible Assets - VIA, topic 4, proposed systematization and in item 4.3 Canvass of Intangible Coefficient - CIC.

Another finding was to identify and systematize the point that demands special effort in the process of measuring intangible assets, which is the synthesis and analysis of the financial structure of the organization, as it seeks to obtain from the financial statements the investments made and that value added to the companies and which should be used in the process of evaluating companies to measure their ability to generate wealth in terms of past, present and future as presented in the formula Value of Intangible Assets - VIA, topic 4, proposed systematization and in item 4.2 Canvass of Intangible Value.

As a contribution to the knowledge about valuation of organizations, the proposed procedures for determining the value of intangible assets can be cited, such as the discovery of the critical moment in the process of identifying intangible wealth aggregating variables in quantitative and qualitative terms. For this purpose, use qualitative factors, turn in a quantitative coefficient synthesized in the Canvass of Intangible Coefficient - CIC.

It is concluded that the fundamental finding of the present research is the systematization of the process of Valuation of Intangible Assets, denominated Value of Intangible Assets - VIA, by the formula VIA = (IAR + CIV) × (1 + CIC), transposes, thus, the fine line of this knowledge. This and other findings are useful to advance the frontier of the intangible assets theme.

It is recommended in future research to deepen a study on the evaluation of intangible assets in distinct entities, researching their peculiarities and their reality, such as the measurement of these assets to individuals, with a focus on competitiveness, professionalism and, also, for the legal field, so that they can serve as a basis in lawsuits.

It is recommended for future research to devote efforts to similar works and how intangible assets can contribute to the practice and decisions of non-profit entities, as well as their maintainers.

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