Analysis of subjectivity in measuring assets assessed by level 3 of the fair value hierarchy

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Abstract

The study aims to analyze the accounting treatment applied in measuring biological assets that reach level 3 of the fair value hierarchy by publicly traded Brazilian companies. The sample consisted of 12 companies, and data were collected in the Explanatory Notes from 2015 to 2019. Information on asset measurement methods, subjectivity, risks, and measurement uncertainties was investigated. The results show that companies classify these assets as having a more uncertain and subjective measurement. The most used measurement method is the discounted cash flow, and six companies apply the discount rate based on the weighted average cost of capital. In general, the measurement of assets is not well evidenced, making it difficult for the user to understand. The study contributes to discussions about the increased subjectivity arising from more complex accounting practices, which involve greater judgment and application of internal estimates in measuring biological assets. The increase in subjectivity requires better clarification so that the information is understood. Companies with biological assets measured at level 3 of the fair value hierarchy need to assess the trade-off between the subjectivity of the estimates applied and the increase in information asymmetry to external users.

Keywords: Biological Assets, Measurement, Subjectivity.

1. Introduction

The study aims to analyze the accounting treatment applied in measuring biological assets that reach level 3 of the fair value hierarchy by publicly traded Brazilian companies. Accounting measurement is a relevant process in generating accounting information and must be covered by adequate and concise criteria to ensure that the best possible measurement has

been assigned (GIBBINS; WILLETT, 1997). Furthermore, measuring an object or event can often be a complex process.

Part of this complexity relates to the subjectivity of the measured item and the designated measurement method. The measurement process can become subjective for several reasons, such as the absence of an active market for evaluation; absence of an acceptable measurement method; high volatility of the measured object or event; use of estimates and internal judgments in measurement (HENDRIKSEN; VAN BREDA, 1999; MUCILLO; NOGUEIRA, 2015; YANG; ROHRBACH; CHEN, 2005).

The use of fair value in certain situations is seen as a more subjective measurement (WALTON, 2006). Generally, assets measured at fair value with a price available in the market have less subjectivity. However, for some biological assets, the process can reach a high degree of complexity and subjectivity. Biological assets, by nature, are in a constant process of transformation, and this causes the historical cost to become outdated in a relatively short period, which is one of the arguments for the introduction of fair value as a basis for measuring biological assets (BOHUSOVÁ; SVOBODA, 2011; DALY; SKAIFE, 2016; SELAHUDIN *et al*., 2018). Among the biological assets with more subjective measurement are those in which there is generally no active market; that is, to measure them, evaluation is needed by internal estimates and the judgment of the entity, which can impact the reliability of the information generated (MUCILLO; NOGUEIRA, 2015; YANG; ROHRBACH; CHEN, 2005).

Some studies on biological assets have discussed the relationship between measuring assets at historical cost or fair value, trying to understand whether there is a more relevant measurement; this is the case of Barros *et al*. (2012), Daly and Skaife (2016), Ferreira and Teixeira (2018), Huffman (2018), Martins, Machado, and Callado (2014) and Silva Filho, Martins and Machado (2013). However, these studies are not conclusive about the superiority of one measurement method. Other works specifically address measurement by estimating fair value and how companies deal with this practice (for example, CAVALHEIRO *et al*., 2019; LENTO; BUJAKI; YEUNG, 2018). The present study differs from the others as it focuses on the subjectivity of measurement exclusively of biological assets valued at level 3 of the fair value hierarchy.

As biological assets can be relevant components of the assets of the companies that trade them, the selection of the measurement method for these assets has become essential in accounting (GUO; YANG, 2013). According to Guo and Yang (2013), on the one hand, using

historical cost to measure biological assets is reliable but may be irrelevant; on the other hand, the use of fair value to measure biological assets may be relevant but not reliable.

It is believed that biological assets with greater subjectivity, measured by level 3 of the fair value hierarchy, from now on referred to as ABN3VJ, should be better evidenced in terms of the accounting treatment adopted in the measurement. This assumption is assumed since they are assets that offer more significant risk. In addition, the company should be inclined to disclose them more transparently and verifiable to the external user to reduce information asymmetry since the subjectivity involved in measuring these assets is seen as a point that exacerbates information asymmetry (HERBOHN; HERBOHN, 2006).

Currently, the IASB and FASB identify decision utility as the objective of financial reporting. However, unfortunately, accounting research has not yet presented a measure that is indisputable in evidencing utility, nor a sufficiently satisfactory method to classify measurement concepts, such as fair value or historical cost, to their usefulness relative to the decision (GASSEN; SCHWEDLER, 2010. Therefore, this study discusses accounting measurement in this context, considering a specific, practical, and complex situation.

The study uses data extracted from the explanatory notes of publicly traded Brazilian companies that present ABN3VJ balances to discuss the subjectivity of measurement. The documents are available on B3's website, and the analysis period comprises the years from 2015 to 2019. The information in the explanatory notes is used for content analysis on the accounting treatment related to asset measurement.

The results showed that most companies report the measurement method used to estimate fair value. Eleven of the twelve companies analyzed used the discounted cash flow method for estimation. Six of these eleven companies apply the WACC (Weighted Average Capital Cost) to determine the discount rate. The use of WACC must be done with care, under penalty of incurring conceptual and calculation errors, as pointed out by Fernandez (2008).

In general, the composition and revaluation of the discount rate are not well evidenced by the companies in the sample, the risks arising from the measurement applied, strategies for dealing with measurement risks, and attributes that are difficult to measure. Approximately 31% of companies disclose in explanatory notes that there are attributes that are difficult to measure.

Improving the quality of accounting information is commonly the focus of debates, either by agencies such as IASB and FASB, in the academic environment or by those involved with the financial market. Accounting information is expected to be relevant, understandable, and reliable; in this sense, the study presents contributions by showing that

the ABN3VJ measurement process involves greater subjectivity and needs improvements that make its disclosure more enlightening. The subjectivity in measuring biological assets increases the information asymmetry between the entity and users. This evidence reveals that companies with ABN3VJ need to assess the trade-off between the subjectivity of the applied estimates and the increase in information asymmetry to external users.

Finally, one last piece of evidence that stands out from the study is that some companies in the sample do not report changes in the discount rate of flows during the analysis period, even in a constantly changing market scenario.

This research is essential for the thematic axis of costs for decision-making, as it deals with the process of measuring assets relevant to the agribusiness area. The focus is on the information disclosed to the external user through its financial accounting, but the internal user can use it for decision purposes.

2. Accounting Measurement and Subjectivity

Measurement is a relevant premise within the accounting process. However, its application can sometimes be complex and challenging. In a more straightforward concept, accounting measurement is defined as the process in which monetary values are assigned to the measured objects (ARAÚJO 2014; HENDRIKSEN; VAN BREDA, 1999; SANTOS *et al.*, 2007; SARLE, 1977). However, it is not limited to monetary attribution, with monetary attribution being one of the ways of measuring. The measurement should be designed so that the amount attributed reflects the characteristics of the measured item. As Sarle (1997) states, the relationships between numbers should reflect the relationships of the attributes of the things being measured. What is measured in itself is not the object or event but its characteristics (ARAÚJO, 2014).

In this perspective, Staubus (1986) approached that the measurement theory itself would be classified as a normative theory under the argument that it provides general information about how the measurement must be carried out so that the specific objective that one has is achieved. Measurement should link a formal system to a numerical system through pre-established rules with connected operational definitions (KAM, 1990). Gibbins and Willett (1997) argue that accounting numbers derived from measurement are statistics with properties that affect decisions and demonstrate their general utility.

Often the items to be measured have different characteristics, and the measurement process will need to choose which attributes will be measured (SARLE, 1997), as the

measurement will not be able to incorporate all the attributes of the object or event. Attributes, when easily observable, tend to facilitate the logical and appropriate measurement process. However, this does not always involve subjective elements relevant to the measured item. Willett (1987) states that representing attributes by numbers can be a significant challenge, as other numbers could validate the measure. The measurement should be considered valid if it measures what was proposed and is sensitive to segregate different levels of measurement, being accurate as it remains constant in repeated measurements (ARAÚJO, 2014).

Hille (1997) establishes that the criteria adopted in the measurement process must be logical. These degrees of logic must be open to discussion, being flexible when more subjective elements are part of the measurement process, aiming to represent the object adequately. The attributes and purposes of measurement are also susceptible to change over time. Thus, the measurement must consider updating the numbers representing the objectives or events evaluated (ARAÚJO, 2014).

According to Ijiri (1967), a system is reliable when it works as expected. Moreover, in accounting, it must function to generate a measurement that reflects information relevant to the user. A consistent measurement must preserve the appropriate characteristics to represent best the measured objects (HENDRIKSEN; VAN BREDA, 1999). The growing need for non-monetary data, added to subjective elements of accounting measurement, increases the number of attributes that can be measured (ARAÚJO, 2014).

As a result of these discussions, measurement is not an exact process; it must approach as closely as possible what could be accepted as accurate (LARSON, 1969). The lack of consensus in the choice of measurement standard and variations in the price level are some of the challenges that permeate accounting measurement (ARAÚJO, 2014). Willett (1987) further notes that the problem of disclosing accounting information is often caused, in part, by the measurement challenges (numerical information) available to include in a set of financial reports.

When studying a compilation of works that discuss accounting measurement, several elements associated with increased subjectivity in the measurement process are identified (ARAÚJO, 2014; IUDÍCIBUS, 2004; IUDÍCIBUS; MARTINS, 2007; NIYAMA; SILVA, 2021). The increase in subjectivity, in some cases, is inherent to the entity's will. Although specific times the more subjective measurement may be characteristic of certain assets (for example, intangibles, goodwill, and biological assets valued by internal estimates), the substantial increase in subjectivity can increase the problems associated with measurement (ARAÚJO, 2014; SOUZA FILHO, MACHADO; MACHADO, 2013; WALTON, 2006).

Among the main aspects that interfere in the subjectivity of measurement, the ones mapped in this study are: existence or increase of attributes that are difficult to observe; the difficulty in approaching the actual value; the various measurement parameters can increase the opacity of the results; living with terms with a high degree of uncertainty, such as the estimated fair value; the quest to measure specific items in a relevant way is a challenge, as relevance prints the utility relationship that the user will attribute to the item the uncertainties about the measurement of the ability to generate future economic benefits the impacts caused by the measurer, which applies assumptions and makes judgments; the problems caused by the chosen measurement instruments, such as flow discount methods, the discount rates applied, among others; lack of clarity regarding the attribute that should be measured and limitation of data availability; the need to make projections about the future, which is a complex and error-prone process; and the specific aspects of the environment, such as lack of verifiability of the assumptions adopted to value the asset (ARAÚJO, 2014; IUDÍCIBUS, 2004; IUDÍCIBUS; MARTINS, 2007; NIYAMA; SILVA, 2021; BARBOSA, 2021).

The increased subjectivity in the measurement process can challenge the accounting and economic environment. The increase in the complexity of the measurement method reduces the external user's ability to verify the reliability of the applied measurement (MOSHCHENKO *et al.*, 2017; SOUZA FILHO *et al.*, 2013). In addition, more subjective processes linked to the use of estimates and judgments may leave doubts as to whether the adequate representation of the measured attribute was effectively achieved (MOSHCHENKO *et al.*, 2017). If the measurement process involves a high level of subjectivity, non-quantitative or non-monetary information should be provided in explanatory notes (RIAHI-BELKAOUI, 2004). In this case, the notes supplement the user's lack of information or seek to generate guarantees that the processes were prepared to represent the measured item better.

3. Historical Cost and Fair Value

Before starting the notes reserved for this section, it is necessary to make a reservation. Although other measurement bases are discussed in the literature, the study only addresses historical cost and fair value, in line with the empirical discussion proposal presented in section 5. It is understood that historical cost and fair value are measurement bases that represent two interesting counterpoints of analysis: input and output values.

An interesting discussion about the measurement bases for input values and output values is carried out by Liang and Wen (2007). The authors state that the structural difference

in the two measurement bases leads to systematic differences in the efficiency of investment decisions. The input value basis is less noisy and with more little manipulations, although they are less comprehensive.

According to Hendriksen and Van Breda (1999), the measurement base must consider all the sacrifices to obtain the asset. However, identifying sacrifices can be difficult in a world where interactions are complex. In addition, the type of measurement chosen must show no procedural bias (HENDRIKSEN; VAN BREDA, 1999). How the measurer measures, evaluates and reports economic transactions through profits and cash flows affect the capital market, user decisions, and the allocation of resources in the economy (KANODIA, 2006).

The historical cost is the acquisition value of an asset by an entity, including the expenses incurred for its effective operation (HENDRIKSEN; VAN BREDA, 1999; IUDÍCIBUS, 2004, NIYAMA; SILVA, 2021; SANTOS *et al*., 2007). Reliability is usually the primary justification for using historical cost; it is assumed that the values are verifiable (IUDÍCIBUS, 2004, IUDÍCIBUS; MARTINS, 2007; NIYAMA; SILVA, 2021). In addition, the desire for measurement to be as objective as possible maintains the predominance of historical costs in measuring a significant part of assets (HENDRIKSEN; VAN BREDA, 1999).

On the one hand, entities are assumed to seek the lowest cost in acquiring their assets; if so, it is understood that, in a way, the historical cost may be representative of this lower cost obtained on the acquisition date (HENDRIKSEN; VAN BREDA, 1999). On the other hand, one of the most significant disadvantages pointed out of historical cost is its rapid lag potential due to changes in market conditions, including price variations over time; this method's sensitivity will be even more significant for long-term assets (IUDÍCIBUS, 2004; SANTOS *et al*., 2007). The longer the period of use, the greater the cumulative effect of the price variation between the date of acquisition and the total period of use (HENDRIKSEN; VAN BREDA, 1999).

The fair value, on the other hand, includes the current factors relevant to the price of the item in the market (HENDRIKSEN; VAN BREDA, 1999). The IASB's conceptual framework defines fair value as the price that would be received to sell the asset or paid to transfer the liability in an orderly transaction between market participants at the measurement date; in addition, this value should reflect the perspective of market participants. For Iudícibus and Martins (2007), fair value is not a specific valuation basis that can be generalized to financial statements.

Some researchers view the use of fair value with reservations. Iudícibus and Martins (2007) state that replacing bases at entry values (for example, historical cost) with other bases, such as fair value, without the possibility of formal and objective auditing, is worrying. Niyama and Silva (2021) make six considerations about fair value: (1) it makes measurement more volatile and subjective, (2) it makes verification more complicated, and (3) it is a complex measurement, with more incredible difficulty in measuring assets that reach level 3 of the fair value hierarchy, (4) its application requires in-depth knowledge of finance, (5) there is a constant need to review the measured value and, finally, (6) its application tends to demand an increase in grades explanations, due to more precise explanations related to the measurement method used to find the fair value.

However, Bonaci, Matis, and Strouhal (2010) state that, despite the additional implications that fair value imposes, it would have the role of bringing the measurement as close as possible to what is called "reality"; and that the criticisms that are made of fair value arise from the responsibility of the measurer to implement the measure correctly, transparently and adequately.

Although Walton (2006) states that the profits or losses determined by the entity when measuring the fair value would effectively not change in the long term, although their recognition may occur in periods other than the historical cost, the literature points to a relative preference for assets are measured at input values (EDWARDS; BELL, 1961; HENDRIKSEN; VAN BREDA, 1999; IUDÍCIBUS, 2004). Hendriksen and Van Breda (1999) state that exit values are usually well accepted for measuring assets when the value is easily realizable in the market, which is not always the case.

Thus, it is possible to perceive that there is no consensus on the superiority of one or another measurement method in the literature. At certain times, fair value is seen as the one that preserves greater relevance of the characteristics of the measured item. However, at other times, historical cost is defended as a more reliable basis for measurement.

After understanding the main points and counterpoints between historical cost and fair value, the following section presents reflections on biological assets that are assets measured at fair value or historical cost, depending on the judgment on the reliable measurement estimates that the entity holds.

4. Reflections on Biological Assets: Measurement

A biological asset is a living animal or plant, from planting or birth to slaughter or harvest. Agricultural production is the product harvested from existing biological assets (CPC 29, 2009, p.4). Several factors influence the valuation of biological assets, such as climatic relationships, soil conditions, geographic location and supply, and demand (BOHUSOVÁ; SVOBODA, 2011; CAVALHEIRO *et al*., 2019; DALY; SKAIFE, 2016).

Determining the measurement basis for biological assets is a controversial issue. Even before IAS 41, discussions were already promoted due to the disagreement between the various users of accounting information regarding the measurement method (DALY; SKAIFE, 2016; SILVA FILHO, MARTINS; MACHADO, 2013). In addition, the accounting treatment of biological assets is complex, especially its measurement and disclosure criteria (COSTA *et al*., 2018; PIRES; RODRIGUES, 2008).

The subjectivity that involves biological assets, caused by the measurement methods adopted in companies, is seen as a point that aggravates the information asymmetry between the entity and the external users of accounting information (HERBOHN; HERBOHN, 2006). Due to these asymmetric relationships, there is a need for greater transparency in disclosing information that permeates biological assets (FIGUEIRA; RIBEIRO, 2015). If external users, for example, cannot reconstitute certain measurement bases due to a failure to disclose, this information would lose relevance, with a loss of predictive and confirmatory power.

Currently, the determinations of IAS 41 establish the possibility of measuring biological assets at fair value or historical cost. However, the standard establishes a preference for fair value, assuming that it will adequately reflect the conditions to be measured. Measurement at historical cost is permitted when estimates to measure fair value are unreliable or when the biological asset has a concise duration, when the items may not have undergone significant changes in value.

The question of valuing biological assets shown in the financial statements arises from their measurement method (historical cost or fair value). In historical cost, direct costs are accumulated to transform the biological asset into a productive state. It may require other accounting treatment relationships, such as estimates of useful life, biological asset deterioration, or in some cases, costs associated with land restoration. Historical cost is often seen as more representative of these costs than fair value accounting (DALY; SKAIFE, 2016; SELAHUDIN *et al*., 2018).

However, the historical cost may not be relevant because the aggregation of costs on the transformation of a biological asset is not necessarily mapped to the cash flows expected to be obtained from the expected products of the biological asset, making the information disclosed lose relevance. However, the challenge of using the fair value method to account for biological assets is that they are transformed by periods of growth, degeneration, production, and procreation until harvest, making it difficult to estimate future cash flows. (DALY; SKAIFE, 2016).

Biological assets undergo several transformations over time (growth, maturation, and degeneration); for this reason, the IASB's arguments point out that fair value may be relevant in the measurement, given that these changes cause changes in the quality and quantity of the asset. In addition, the fair value must provide information close to the economic reality to users. Therefore, fair value accounting should gather current information concerning the market and, in this sense, could provide a more solid basis for forecasting values, making disclosure more useful (FERREIRA; TEIXEIRA, 2018).

The issuance of the International Accounting Standards 41 Agriculture (IAS 41) made the sectors with biological assets begin to observe this specific standard aimed at accounting for the operations of these assets (RECH; OLIVEIRA, 2011). The changes introduced then by IAS 41 established new guidelines for the accounting treatment of biological assets. However, the new guidelines assume that entities have adapted their practices to a more reliable representation of accounting information (FIGUEIRA; RIBEIRO, 2015).

Thus, the challenge to better measure biological assets is understandable. The most appropriate measurement contributes to the dissemination of timely and material information (FIGUEIRA; RIBEIRO, 2015). Due to the increased complexity of information related to biological assets, caused mainly by the more subjective measurement, the accounting policies must be coherent and transparently elucidated, expressing the accounting treatment given to biological assets (FIGUEIRA; RIBEIRO, 2015).

Among the studies carried out with an approach to biological assets, some findings from national and international research are mentioned below. In addition, some studies have been conducted, evidencing the concern regarding measuring biological assets at fair value or historical cost.

Silva Filho *et al*. (2013) show that although the valuation of biological assets at historical cost does not reflect their ability to generate economic benefits, measurement at historical cost and fair value proved relevant to the Brazilian market. Cairns *et al*. (2011) reveal that although adopting international accounting standards has provided some incentive

for using fair value; there is still a conservatism bias or lack of incentive for using fair value measurement. The findings of Daly and Skaife (2016) somewhat corroborate the assertions of Cairns *et al*. (2011), revealing that an analysis of the measurement at fair value or historical cost carried out in 28 countries after the adoption of IAS 41 encourages the use of fair value, most of the companies studied maintained the measurement of their assets at cost historic.

Other relevant evidence involving biological assets is presented in the findings by Silva, Nardi and Ribeiro (2015). The authors show consistent evidence that companies with measurable biological assets, according to their estimates and that use the discounted cash flow method to measure fair value, are more likely to practice earnings management.

The results evidenced in two international studies contrast. On the one hand, Huffman (2018) presents findings that information on earnings is significantly more relevant when companies measure biological assets at historical cost. According to Huffman (2018), investors discount unrealized gains and losses associated with fair value when companies measure biological assets at fair value. However, Hadiyanto, Puspitasari, and Ghani (2018) show that companies that use historical cost measurement of biological assets produce less reliable and less relevant information than those that use fair value measurement. This contrasting evidence shows that research on the subject still contributes much to the discussion.

Souza Filho *et al*. (2013) argue that measuring the historical cost of biological assets is relevant to users because it is a more verifiable, objective, and easy-to-understand measurement. On the other hand, fair value is usually calculated based on internal estimates, making the measure more challenging to understand, which may be one of the reasons why the measure is not so relevant to the external user (SOUZA FILHO *et al*., 2013).

IAS 41 establishes criteria for recognition, measurement, and disclosure of biological assets to be applied by entities. IAS 41 is in line with the fair value measurement standard, as biological assets are also recognized at fair value. This relationship makes the elements classified as biological assets items with a high degree of subjectivity, especially when there is no active market, resulting in the need to evaluate the entity through estimates and judgment, which can impact the reliability of the information generated (FIGUEIRA; RIBEIRO, 2015); MUCILLO; NOGUEIRA, 2015; YANG, ROHRBACH; CHEN, 2005).

In this scope, Silva Filho *et al*. (2013) also discuss the subjectivity of biological assets measured at fair value based on estimates. The authors point out that the less there is an active market, the more subjective the measurement; this will imply a greater possibility of bias and measurement errors, as valuation techniques require the definition of a discount rate,

estimates of cash inflows and outflows, and the period in which cash flows will flow to the company.

Given the approaches presented in sections 2, 3, and 4, it is expected that publicly traded Brazilian companies, whose biological assets are valued at level 3 of the fair value hierarchy, are adequately explaining the accounting treatment applied in the measurement. This assumption is assumed because it is an internal evaluation procedure and involves subjectivity. The procedures adopted for evaluating the subjectivity of the measurement of ABN3VJ are explained in the following section.

5. Methodological Procedures

This documentary research uses content analysis of policies related to the accounting treatment of biological assets, together with the confrontation between the standard and the practice of companies.

The scope of the research is the accounting treatment applied to Brazilian public companies with biological assets. Therefore, the first information to be checked was the type of biological asset traded by the company and whether it has an active market. This information was essential to separate the biological assets that could be evaluated by level 1 or 2 of the fair value hierarchy, considering that the study aims to analyze only the accounting treatment given to biological assets of a grander subjectivity scale since these involve the application of internal estimates and management judgment, so only assets valued at level 3 of the fair value hierarchy make up the analysis sample.

A pattern of analysis of the information was developed to analyze the information regarding the accounting treatment that companies apply following a script containing nine questions, presented in table 1. The purpose of this script was to help the analysis and maintain a formal procedure when analyzing the companies' information, keeping the standard for all periods and companies. Although table 1 was prepared by the authors, it was built based on the elements in the literature and discussed in section 2 and the following elements elucidated in CPC 29, which is the pronouncement corresponding to IAS 41 in Brazil.

Table 1: Analyzed Information on Fair Value Measurement

No.	QUESTION
1	Does the entity inform the method used to measure ABN3VJ?

2	Does the entity explain the assumptions made in the estimates and judgments for measuring the fair value of biological assets valued at level 3?
3	If the method adopted involves discounting flows, does the entity inform the discount rate applied in measuring the fair value of biological assets valued at level 3?
4	If the method adopted involves discounting flows, does the entity inform how it composes the discount rate applied?
5	If the method adopted involves discounting flows, does the entity inform how it reassesses the rate used?
6	Does the entity report the risks arising from the measurement significantly if the method impacts the loss of relevance and reliable representation?
7	Does the entity report strategies to deal with the mentioned risks?
8	Does the entity mention the existence of attributes that are difficult to observe when measuring ABN3VJ?
9	If the entity mentions the existence of attributes that are difficult to observe when measuring the assets, does it mention the treatment assigned?

Source: Prepared by the authors.

In addition to the elements presented in Table 1, other relevant information collected during the content analysis was also incorporated into the discussions.

The study intends to present analyses regarding the quality of the information passed on, analyzing the degree of depth that the disclosure evidenced regarding biological assets with more subjective measurement. In this sense, some criticisms were made when there was a lack of information necessary to understand the subject and when the information, despite being disclosed, was disclosed simplistically or insufficiently for its complete understanding. Figure 1 contains the research flow sequence.

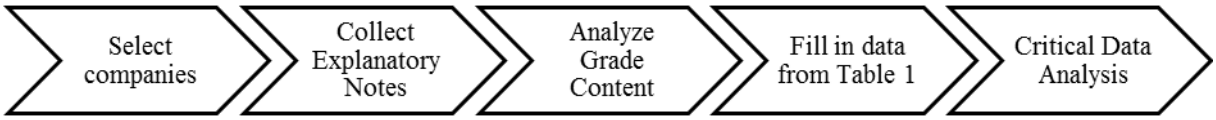

Figure 1: Research Flow

5.1. Sample determination and data collection

The research sample is made up of publicly held Brazilian companies listed on B3 that had biological asset balances that involve measurement by level 3 of the fair value hierarchy. The period of analysis covers the years from 2015 to 2019. This study period was determined due to the similarity between the contents of the explanatory notes over the years. Five years of analysis are believed to understand how companies treat biological assets. The final period of analysis was defined as 2019 due to the unstable environment generated by the New Coronavirus pandemic from the last quarter of 2019.

Table 2: Population and Sample Definition

Panel A - Population and Sample	
Research Period	**2015 to 2019**
Number of Companies	30
Number of Companies that do not have ABN3VJ	(18)
Sample Total	*12*
Panel B - Sample by Year of Study	
Year	**Number of companies/observations**
2015	12
2016	11
2017	10
2018	10
2019	9
Total Observations	**52**

Source: Prepared by the authors

The company selection process initially showed thirty publicly traded Brazilian companies that held biological asset balances in their Financial Statements. However, as the study intends to analyze the ABN3VJ, eighteen companies were removed from the sample, leaving twelve for analysis. Altogether the study analyzed a total of 52 observations. The companies that are part of the study are Biosev S.A.; BrasilAgro – Brazilian Agricultural Property Company; BRF S.A.; Duratex S.A.; Cia de Ferros Ligas da Bahia – FERBASA; Grazziotin S.A. Group; Irani Papel e Embalagens S.A.; Klabin S.A.; Sao Martinho S.A.; SLC Agrícola S.A.; Suzano S.A.; and Trevisa Investimentos S.A.

6. Presentation and Analysis of Results

6.1. Measurement of biological assets - Level 3 of fair value

As discussed in the previous sections, the assumption is that, since the measurement of ABN3VJ involves subjectivity, Brazilian companies with such assets must adequately explain the assumptions and criteria adopted in their explanatory notes. The study results are presented in table 3.

Table 3: Frequency Distribution

	Frequency	
Questions	**Yes**	**No**
Does it inform the method adopted in the measurement of ABN3VJ?	96%	4%
Does it explain the assumptions made in the measurement estimates and judgments?	79%	21%
Does the method involve discounting flows to inform the discount rate applied?	73%	27%
How do you calculate the discount rate if the method involves discounting flows?	62%	38%

How do you re-evaluate the rate used if the method involves discounting flows?	40%	60%
Does it report measurement risks, such as loss of relevance and reliable representation?	46%	54%
Does it inform strategies to deal with the mentioned risks?	37%	63%
If there are attributes that are difficult to observe in the measurement, does it mention the treatment assigned?	31%	69%

Source: Prepared by the authors

Of the twelve companies analyzed, only one of them did not inform the measurement method used to evaluate their ABN3VJ. Grazziotin presented a balance of these biological assets only in the years 2015 and 2016, and in those years, it did not show any information about the criteria for measuring biological assets in the explanatory notes; the company only informs that they are pine forests and indicates that an external expert evaluates the assets. The other companies that make up the study sample reported measuring ABN3VJ by the discounted cash flow method. This method was maintained for all the years of analysis.

In 79% of the reports analyzed, the companies explained the assumptions made in the estimates and judgments of measuring the fair value of ABN3VJ. These assumptions refer to information related to the elements that are considered when applying the method for measuring biological assets that involve internal estimates and judgments, such as: production and productivity estimates by area and by quantity in tons; price of the final product, and raw material on the market; production costs (such as planting, and maintenance); forest age and average forest formation cycle (in the case of forest biological assets); cost of leased and owned land; exchange rate; freight and other types of transport; harvest; interest rates; and others.

Companies that produce sugarcane report that, among the assumptions made in estimating fair value, they consider data provided by the Council of Sugarcane, Sugar and Alcohol Producers (CONSECANA), especially information related to the reference price per ton of sugarcane published monthly.

Although all companies, except Grazziotin, indicate using the discounted cash flow method to measure biological assets, approximately 27% of the sample did not report the discount rate used. Biosev, BRF, Duratex, Ferbasa, Klabin and Suzano use a discount rate based on the weighted average cost of capital (WACC - Weighted Average Capital Cost), and Irani uses a discount rate based on the cost of equity (CAPM - Capital Asset Pricing Model). The other companies that reported the discount rate only reported the rate but did not mention the basis used for its composition.

In approximately 62% of the observations, it was found that the companies informed in the explanatory notes that the assumptions assumed to compose the discount rate applied in

the method of measuring biological assets. However, it is noteworthy that these revealed assumptions are generally superficial and may not give the reader a full understanding of how the company arrived at the determined rate; it is only possible to understand the reasons that led companies to adopt the WACC and CAPM for those who do.

Although 40% of the analyzed observations showed the companies' concern to indicate that they reassess the discount rate periodically (some quarterly, others annually), the explanation of how this reassessment is carried out is insufficient for its complete understanding. Duratex, for example, informs that variations in market situations imply the need to review the rate, but does not clarify the variations or procedure for market observations and rate recomposition. Similar indications are found in the companies Ferbasa and Irani. The company Klabin showed that to form the discount rate, it considers the basic interest rate (Selic) and inflation levels.

Regarding the risks reported by the companies, Ferbasa was the company that most clearly expressed that the measurement process exposes risks. For example, the company shows that "the measurement can generate impacts on net income and, consequently, on the distribution of dividends, due to changes in the assumptions for calculating the fair value of biological assets: such as market prices, forest productivity, and discount rates.".

The company Biosev informs in the item "Sensitivity analyses" that "it does not consider its biological assets (measured by estimate) as sensitive items in the activity." Although the company Irani reported aspects of risks, it did not associate the risk with the applied measurement process. Over the periods of analysis, the company informs in explanatory notes that "there were no events that impacted the devaluation of biological assets, such as storms, lightning, and others that could affect the forests." Duratex, as of 2018, began to better detail the risk and subjectivity relationship of the measurement process of biological assets, showing that the variation in the price of wood impacts the increase in the fair value of forests and that changes in the rate of discount used also impact the measured fair value.

Suzano, in 2015, reported that the risks were related to the loss of the biological asset itself and not the measurement applied. As of 2016, Suzano reformulated some items in the notes and started to present "Sensitivity Analysis," stating that "due to the complexity and calculation structure" [...] the fair value of forests (level 3 of the hierarchy) are "the most sensitive ones where increases in these assumptions generate relevant gains and reductions in assumptions cause significant negative impacts on the measurement of fair value." Klabin provided similar evidence when it reported in the item "Sensitivity Analysis" that "Significant

increases (decreases) in the prices used in the valuation would increase (decrease) in the measurement of the fair value of biological assets" and that "significant effects of increase (decrease) of the rate used to measure the fair value of biological assets, would lead to a decrease (increase) in the measured values."

Regarding strategies to deal with risks, the strategies highlighted by 37% of the sample consist of periodically reviewing the discount rate, and it is necessary to recognize the gain or loss.

Biological assets can be relevant components of the assets of the companies that trade them, so selecting the appropriate measurement attribute for these assets is relevant (GUO; YANG, 2013). The data presented in table 3 reveals that 31% of the sample shows that the measurement of ABN3VJ contains attributes that are difficult to measure. Although these companies mention the existence of attributes that are difficult to observe, they end up being generic and do not detail which attributes are the most difficult to measure, revealing that the measurement becomes more sensitive and more complex, primarily due to the required calculation structure.

Finally, in addition to the eight questions in table 3, question 9 asked: "If the entity mentions the existence of attributes that are difficult to observe when measuring the assets, does it mention the treatment assigned?". When analyzing the information disclosed, it was not possible to find evidence that the companies in the study reported the treatment assigned in the measurement process in the presence of attributes that are difficult to measure.

6.2. Reviews and Discussions

When analyzing the explanatory notes, specifically the contents that are elucidated about the accounting treatment applied to biological assets, it was found that all the companies in the sample clearly show that the biological assets sugarcane and forests (eucalyptus and pine) are ABN3VJ and that for their measurement use internal estimates that contain levels of uncertainty and subjectivity. Biosev, Duratex, Klabin, and Suzano present a sensitivity analysis topic in the explanatory notes. They classify the aforementioned biological assets as susceptible items mainly from the attributes listed in the measurement process. Duratex classifies its ABN3VJ as its "assets with critical accounting estimates and judgments," as the "estimates were based on market references," which "are subject to constant changes in the scenario," which may "impact the financial statements."

The more subjective processes that impose the use of internal estimates and management judgments may leave doubts as to whether the adequate representation of the measured attribute was effectively achieved (MOSHCHENKO *et al*., 2017). Gibbins and Willett (1997) state that the attribution of value must be covered by adequate and concise criteria that allow inferences of the best possible measurement. The entity's judgments can impact the reliability of the information generated (MUCILLO; NOGUEIRA, 2015; YANG; ROHRBACH; CHEN, 2005).

Regarding the measurement of the fair value of forest assets, Pereira *et al*. (2020) claim that it is difficult to determine, as the production cycle is usually long, and changes in assumptions over time can generate significant variations. These intercurrences can affect the decisions of external users, as variations generate increased uncertainties about the information disclosed.

Some highlights need to be made in the study regarding accounting treatments that are insufficient to understand users fully; it is understood that the user of accounting information must have a knowledge base to understand the disclosed elements. However, some companies fail to disclose contents that are insufficient for the user to be able to analyze the applied measurement. About this prerogative, Moshchenko *et al*. (2017) and Souza Filho *et al*. (2013) make warnings applicable to the studied cases that the increase in the complexity of the measurement method decreases its reliability and the user's verification capacity.

In this sense, the case of the company Grazziotin stands out; although the entity has ABN3VJ, it is limited to mentioning that a specialized expert carried out the measurement. Other measurement information is not disclosed. This may be inadequate for users to understand; for example, Suzano also informs that it hires a specialized team to measure the fair value of ABN3VJ but presents additional information, such as the discount rate and fair value revaluation period, among others. It is believed that informing only the hiring of specialized services is insufficient for user understanding.

Another piece of information that stands out concerns the discount rate applied. During the five years of analysis, some companies did not report whether there were changes in the discount rate of flows practiced. It is understood that this information is inconsistent with market expectations because the country's economy does not remain static over five years, even if a particular sector may not undergo many changes in the economic scenario, at least the basic interest rate. (Selic) changes. It should be noted that the Selic rate is mentioned in the study as a component of the discount rate.

SLC Agrícola informs in its ABN3VJ measurement assumptions that while there are only minor biological transformations and the impact of the transformation of the biological asset on the price is not expected to be material; the historical cost is considered to be the fair value. However, a slightly different judgment is reported by the company Klabin, which shows that eucalyptus forests are maintained at historical cost until the third year of planting and pine forests until the fifth year of planting because of the Management's understanding that during this period, the historical cost of biological assets approaches their fair value. Therefore, Duratex adopts a judgment different from Klabin for eucalyptus forests. At the same time, Klabin maintains the historical cost until the third year of planting, as it deems this to be the fair value of the forests. Duratex judges that the historical cost is only representative of the fair value of eucalyptus forests in the first year of planting. Factors like this make it clear that the judgment, even for similar items, can be very different from one company to another, making it even more difficult for the external user to verify.

The increase in items that are difficult to observe contributes to the increase in complexity, which makes the measurement more subjective. The more subjective measurement increases uncertainty about the asset, so the accounting treatment must be coherent and transparent (FIGUEIRA; RIBEIRO, 2015). Therefore, companies need to identify better the elements with the lowest observation potential when measuring biological assets and improving the information disclosed. In this sense, Ferbasa, for example, was more transparent; the company shows that "the calculation of the fair value of biological assets takes into account several assumptions with a certain degree of judgment [...] Any changes in these assumptions used can impact the change in the result of the discounted cash flow and, consequently, the appreciation or depreciation of these assets". In addition, the company discloses the assumptions observed for measuring biological assets.

Unlike Ferbasa, Brasilagro has generic information when measuring its biological assets, stating that the measurement method is based on "those practiced in the market" and that changes in these assumptions may affect the fair value of biological assets. However, the company does not show which market practices or assumptions are observed in the measurement. Like Brasilagro's behavior is BRF's behavior when exposing unobservable measurement data. BRF discloses that "the fair value of biological assets is determined through unobservable data, using best practices". However, it does not explain what the best practices available would be.

Thus, the final findings of the study are that: even though the companies clearly show that the ABN3VJ are their most sensitive assets; they are exposed to market fluctuations, and

that market changes can impact the measurement and financial statements; they are assets with critical estimates and judgment, the information disclosed still leaves something to be desired in the sense of a proper understanding of the criteria related to the choice of the method, the determination of the hard-to-observe items, the measurement risk mitigation practices, and about more uniform and consistent criteria for determining the discount rate.

This evidence contradicts the assumptions made in the study that the more subjective biological assets would be better evidenced in terms of the accounting treatment adopted in the measurement. Although more subjective measurement may be characteristic of these assets, the substantial increase in subjectivity can increase the risks associated with measurement (ARAÚJO, 2014; SOUZA FILHO, MACHADO; MACHADO, 2013; WALTON, 2006), in addition to the lack of adequate subsidy understanding, increases the information asymmetry between external users and the entity (HERBON; HERBON, 2006).

7. Conclusion

This research is a study on the accounting treatment related to the subjectivity of the measurement of ABN3VJ. Elements such as the measurement method, internal estimates, risks, and uncertainty when measuring assets are investigated based on the information shown in the explanatory notes of the companies that make up the study sample.

The results revealed that eleven of the twelve companies analyzed used the measurement method used to estimate fair value, and all used the discounted cash flow method. Six of these companies apply the WACC in determining the discount rate. The research findings show that, in general, companies do not adequately show how they compose and reassess the discount rate, the risks arising from the applied measurement, the strategies to deal with these risks, and the attributes that are difficult to measure.

The study contributes to those interested in the financial market, academic environment, and regulators by showing that the ABN3VJ measurement process involves greater subjectivity and needs improvements that make its disclosure more enlightening. The subjectivity in measuring biological assets increases the information asymmetry between the entity and users. This evidence reveals that companies with ABN3VJ need to assess the trade-off between the subjectivity of the applied estimates and the increase in information asymmetry to external users.

The study also contributes to the journal's knowledge area because the information on the measurement of ABN3VJ is used for decision purposes, both for the internal user and the external user.

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