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# Influence of the method of measurement of biological assets in the quality of earnings

## Influência do método de mensuração de ativos biológicos na qualidade dos lucros

## Influencia del método de medición de activos biológicos en la calidad de los lucros

**Marcos Paulo Rodrigues de Souza***
Doctor in Regional Development and Agribusiness (UNIOESTE)
Adjunct Professor (UNESPAR), Paranavaí/PR, Brazil
marcos.paulo@unespar.edu.br
https://orcid.org/0000-0002-4212-9895

**Claudio Marques**
Doctor in Sciences at FEA (USP)
Adjunct Professor (UEM), Maringá/PR, Brazil
cmarques@uem.br
https://orcid.org/0000-0001-5715-3014

**Ilirio José Rech**
Doctor in Accounting and Controllership at FEA (USP)
Adjunct Professor (UFG), Goiânia/GO, Brazil
ilirio.jose@ufg.br
https://orcid.org/0000-0001-7027-737X

**Primary contact address for correspondence***
Av. Gabriel Esperidião, S/N, Jardim Morumbi, CEP: 87703-000, Paranavaí/PR, Brazil

**Abstract**
The study aimed to identify the influence of the biological assets measurement method on the quality of earnings of companies that explore agricultural activities. Data from 2009 to 2017, from a sample of 228 companies listed in 39 countries, were collected on the *Thomson Reuters Eikon*® platform and analyzed using multiple linear regression. The quality of earnings proxy was based on the model developed by Dechow and Dichev (2002). The main result revealed that adopting the fair value method for measuring biological assets had adverse effects on the quality of earnings in relation to the historical cost. This finding suggests that higher quality of earnings is obtained when biological assets are measured by the cost method.
**Keywords:** IAS 41; fair value; historical cost

**Resumo**
O objetivo do estudo foi identificar a influência do método de mensuração de ativos biológicos na qualidade dos lucros das empresas que exploram atividades agropecuárias. Os dados do período de 2009 a 2017, de uma amostra de 228 companhias listadas em 39 países, foram coletados na plataforma *Thomson Reuters Eikon*® e analisados por meio de regressão linear múltipla. A *proxy* de qualidade dos lucros foi baseada no modelo desenvolvido por Dechow e Dichev (2002). O principal resultado revelou que a adoção do método de valor justo para mensuração de ativos biológicos produziu efeitos negativos na qualidade dos lucros, em relação ao de custo histórico. Esta descoberta sugere que lucros de maior qualidade são obtidos quando os ativos biológicos são mensurados pelo método de custo.
**Palavras-chave:** IAS 41; valor justo; custo histórico

**Resumen**
El objetivo del estudio fue identificar la influencia del método de medición de activos biológicos en la calidad de los lucros de las empresas que exploran actividades agrícolas. Los datos de 2009 a 2017, de una muestra de 228 empresas que figuran en 39 países, se recopilaron en la plataforma *Thomson Reuters Eikon*® y se analizaron mediante regresión lineal múltiple. El proxy de la calidad de los lucros se basó en el modelo desarrollado por Dechow y Dichev (2002). El principal resultado reveló que la adopción del método de valor razonable para la medición de activos biológicos tuvo efectos negativos en la calidad de los lucros,

en relación con el costo histórico. Este hallazgo sugiere que se obtienen lucros de mayor calidad cuando los activos biológicos se miden por el método del costo.
**Palabras clave:** NIC 41; valor razonable; costo histórico

## 1 Introduction

Changing the measurement of biological assets from historical cost to fair value has generated controversy in the accounting field applied to rural activities. The literature presents theoretical discussions and empirical results about the problems of measurement, comparability, relevance, and reliability of measurement methods (Elad, 2004; Elad & Herbohn, 2011; Argilés et al., 2011; Argilés-Bosch et al., 2017; Gonçalves et al., 2017; Huffman, 2018).

Nevertheless, the lack of consensus in the literature is worth noting on which method would be the most appropriate to measure biological assets (Argilés et al., 2011). Decisions on which method to measure biological assets involve several alternatives that may result in different valuations for the same asset and, consequently, different values (Martins et al., 2014). As such, entity managers' reporting decisions and long-term strategies can have positive and negative consequences on the quality of earnings (Francis et al., 2006).

The quality of earnings depends on the entity's financial performance and the accounting system that measures it (Dechow et al., 2010). Thus, Elad and Herbohn (2011) argue that the use of different methods for the measurement of biological assets, as well as the lack of comparability of accounting practices, can result in international differences in the quality of earnings, which affects the quality of the information provided by companies that operate in the agricultural sector.

Some measures, such as persistence, conservatism, earnings management, quality of accruals, transparency, level of disclosure, value relevance, and market value reported by companies, are used to measure the quality of earnings (Dechow et al., 2010). In this theme, we opted for the accruals quality developed by Dechow and Dichev (2002) since it is a measure based on the view that earnings that most closely approximate operating cash flows are better quality (Francis et al., 2006).

Therefore, considering the relevance of the measurement of biological assets, it is vital to study their effects on the quality of earnings and provide subsidies to users of accounting information in estimates about the entity's future cash flows. Consequently, this study seeks answers to the following question: **What is the influence of the measurement method of biological assets on the quality of earnings of companies that explore agricultural activities?** Thus, this study aims to identify the influence of the biological asset measurement method (fair value versus historical cost) on the quality of earnings of companies that explore agriculture and cattle-raising activities.

This research is justified by suggesting that users of accounting information should consider the measurement methods of biological assets when the decision-making process is based on the earnings of companies that explore agricultural activities. The evidence presented can be helpful to financial statement preparers in analyzing which method of measuring biological assets provides the best estimates of future cash flows. As a theoretical contribution, this study advances the debate on the controversy between fair value and historical cost for measuring biological assets, notably by including the quality of earnings in discussions involving measurement methods.

The study is organized into five sections, including this introduction. The second section presents the theoretical reference on the measurement of assets at fair value versus historical cost, related studies, and the development of the research hypothesis. The methodological procedures are outlined in the third section. The results of the study are presented and discussed in the fourth section. Finally, the fifth section presents the final considerations, limitations, and suggestions for future research.

## 2 Theoretical framework

### 2.1 Fair Value versus Historical Cost

The introduction of fair value assumptions in the measurement of assets and liabilities by the International Accounting Standards Board (IASB) has stimulated debate about measurement methods and their effects on financial statements. Fair value advocates consider that the method presents values closer to realizable value and claim that the historical cost method records only the financial sacrifice for acquiring or forming an asset.

For Ronen (2008), fair value has two primary purposes in financial statements: (1) information in order to provide capital investors with provisions, measurement, and comparison of amounts, timing, and uncertainties of future cash flows; (2) accountability, to assess how efficiently and effectively management has managed shareholders' capital.

Fair value represents the economic way of measuring capital, comprising the principle of economic essence over legal form, which means the accounting presentation of the real economic phenomenon, thus

serving investors who seek an economic view of companies (Demaria & Dufour, 2007). The reporting of fair value in financial statements draws shareholders' attention to the timely change in the value of their equity, which represents the changes in asset values that will be realized in subsequent periods (Argilés et al., 2011).

This feature of fair value strengthens the role of management as it provides relevant information to stakeholders (Barlev & Haddad, 2003). In addition, fair value removes managers' discretion in delaying the recognition of unrealized losses. Thus, a shift from conservatism, inherent in historical cost, to fair value can be useful as it will reduce the informational advantage of managers over other contracting parties and consequently increase the quality and reliability of financial statements for contracting purposes (Shivakumar, 2013).

Supporters of the fair value method are based on the argument that this method is more informative and relevant. At the same time, critics emphasize its disadvantages, questioning its reliability due to the high degree of judgment involved in the measurement and reporting process in financial statements (Pinto & Pais, 2015).

The discussion on this theme can be seen as a trade-off between relevance and reliability (Martins et al., 2014). If, on the one hand, the managers who adopt the fair value may be concerned about reporting to the market the performance of the companies under their management, on the other hand, the cost method is used to demonstrate the performance only when it is financially realized (Pinto et al., 2015).

The adoption of fair value represents a break with the historical cost since the preparers of the financial statements may be more interested in maintaining the accounting treatments before adopting the *International Financial Reporting Standards* (IFRS) (Demaria & Dufour, 2007). Thus, to maintain their *status quo*, some companies apply more conservative accounting criteria, using presentation and measurement options contained in local standards before adopting IFRS (Martínez et al., 2011).

Regarding this aspect, Watts (2003) criticizes the Financial Accounting Standards Board (FASB) for preferring neutral and unbiased information provided by mark-to-market (fair value) without ensuring the verifiability of market estimates. The author warns that the FASB underestimates the verification necessary to prevent managers from introducing biases in accounting information.

For Whittington (2008), the fair value view assumes that markets are relatively perfect and complete and that, in such a scenario, financial reports should meet the needs of investors and creditors to report the fair value derived from current market prices. However, the author points out that the alternative view of fair value assumes that markets are relatively imperfect and incomplete. In this setting, financial reports should meet the monitoring requirements of current shareholders by reporting past transactions and events based on specific measurements that reflect the reporting entity's reality to increase the accounting numbers' usefulness.

Nonetheless, managers may choose the fair value method to inform the market of the company's *true* value since financial market analysts and investors appreciate it more. It helps mitigate informational asymmetries by estimating the company's future cash flows. On the other hand, managers can use the cost method, which, in turn, is more in line with accounting conservatism, which values the reported information's reliability. Both methods have advantages and disadvantages, and their adoption will depend on each company's specific situation (Quagli & Avallone, 2010).

### 2.2 Biological Assets Measurement

A biological asset refers to a living animal or plant whose biological transformations can be managed to facilitate the changes or provide the primary conditions for the transformation process to develop. The IASB considered this condition of managing biological transformations to establish the fair value as the recommended measurement method.

Thus, the *International Accounting Standard* (IAS) *41 - Agriculture* regulates that the biological asset must be measured at fair value, less selling expenses. If fair value cannot be reliably measured, IAS 41 allows biological assets to be measured at historical cost, less depreciation and impairment loss. An exception to this rule is bearer plants (production biological assets, e.g., fruit trees such as orange trees or sugarcane roots), which, following changes to IAS 41 made by the IASB in 2014, must be measured at cost and accounted for since January 1, 2016, under IAS 16 - *Property, Plant and Equipment*.

The subjectivity of these criteria gives managers the freedom to judge the measurement conditions of biological assets, enabling the management of results, which impacts the companies' results (Argilés et al., 2011; Rech & Pereira, 2012). In the absence of an active market, the measurement of the fair value of biological assets by the discounted cash flow provides subsidies to managers to make projections of more or less conservative results (Silva et al., 2015).

Although the active market is only a theoretical construct, this market exists mainly for some biological assets known as commodities, such as specific categories of cereals that have homogeneous characteristics and are traded in institutionalized markets or commodity exchanges (Lefter & Roman, 2007). In contrast, where there is no active market for a biological asset, simplicity is not a merit of fair value since

the determination of fair value can be costly, particularly in less developed countries, due to the absence of an active market (Elad, 2004; Elad & Herbohn, 2011).

The literature reveals no consensus on the most appropriate method for measuring biological assets (Argilés et al., 2011). Authors such as Argilés-Bosch et al. (2012), Gonçalves et al. (2017), and Argilés-Bosch et al. (2017) argue that information based on the fair value of biological assets contributes to the forecasting of cash flows. Opponents of fair value, such as Elad (2004), Herbohn and Herbohn (2006), and Elad and Herbohn (2011), focus on the difficulties and unreliability of this measurement method because there are no active and liquid markets for some biological assets.

From an accounting practice perspective, the historical cost may be considered more attractive than fair value when professional skills and farm data are available since historical cost information is essential for management purposes. However, when active markets with available prices, homogeneous products, and independent and willing buyers and sellers exist, the fair value appears to be a more straightforward and more useful measurement method for agricultural accounting, as it avoids the complexity of the biological asset cost method, which generally uses approximate cost calculations (Argilés et al., 2011).

Importantly, when measuring biological assets at fair value, the biological transformation process is timely recognized in the financial statements. It enables the investor to estimate the future economic benefit arising from the management of the assets and the effect on the entity's future cash flows (Lefter & Roman, 2007). If, on the one hand, the measurement of biological assets at fair value and the respective recognition of biological transformations in the financial statements affects the performance or financial position of companies, on the other hand, the ability of historical cost to adequately reflect biological transformation is limited if compared to the potential of fair value which is based on current values (Argilés-Bosch et al., 2012). As such, fair value is considered more relevant because it represents the economic reality of the biological transformation (Herbohn & Herbohn, 2006).

Nonetheless, it is essential to highlight that changes in the fair value of biological assets affect the result, impacting in greater volatility the earnings, possibly caused by the recognition of gains and losses on biological assets not realized in subsequent periods, which may compromise the analysis of financial statements (Herbohn & Herbohn, 2006; Lefter & Roman, 2007; Elad & Herbohn, 2011; Aryanto, 2011). Hence, the use of fair value for subsequent measurement of non-financial assets, such as biological assets, defined as the exit price, is conceptually risky once it uses anticipated sales margins, which may not be realized (Dvořáková, 2011).

The volatility of earnings possibly arises because of the recognition of unrealized gains and losses measured at fair value (Elad & Herbohn, 2011), particularly in the case of biological assets with long production cycles, such as forest assets (Herbohn & Herbohn, 2006). In addition, the volatility of the fair value measurement can be affected by the volatility of commodity prices in the agricultural market, changes in government policy, changes in soil and weather conditions, and pest and disease attacks in crops or livestock (Herbohn & Herbohn, 2006).

Another problem with recognizing unrealized revenue in the income statement is dividend distributions (Herbohn & Herbohn, 2006; Lefter & Roman, 2007). Elad (2004) reports that the criticism from professional accounting bodies, banks, and companies is that gains or losses may not be realized. Moreover, for this author, agriculture is not the appropriate environment for recognizing earnings in advance, as it may create frustrated expectations in shareholders about dividend payments.

### 2.3 Related Studies and Hypothesis Development

The literature presents some studies that relate the method of measuring biological assets to the ability to predict future earnings and operating cash flows. The work done by Argilés et al. (2011) revealed greater predictive power of future earnings when biological assets are measured at fair value. However, the authors did not identify significant differences between the fair value and historical cost methods for predicting future cash flows.

For Argilés-Bosch et al. (2017), biological assets influence unpredictability when measured by the cost method. However, when measured at fair value, a higher representativeness of biological assets over total assets results in higher accuracy in forecasting future operating cash flows (Argilés-Bosch et al., 2017).

In analyzing the association between revenue and return and the predictive ability of revenue to estimate future operating cash flows, Huffman (2018) identified significant improvement when firms adopt a fair value for measuring consumable biological assets. On the other hand, the author identified that the association between revenue and return and the predictive ability of revenue to estimate future operating cash flows significantly decreases when firms measure production biological assets at fair value.

Studies on the relevance of accounting information are also on the agenda of discussions about measuring biological assets. There is no unanimity on the subject. For example, Silva Filho et al. (2013) concluded that replacing historical cost with fair value was not relevant for users of accounting information. One justification presented by the authors for this result is that measuring biological assets at historical cost is verifiable, objective, and easily understood. In contrast, fair value measurement, usually calculated based on discounted cash flow estimates, is challenging to understand and may be less relevant to users of

accounting information. In contrast, Martins et al. (2014) concluded that fair value measurement provides relevant and more detailed information about biological assets to capital market users.

Another inherent problem in the fair value measurement is related to the maturity period of biological assets. Martins et al. (2014) evaluated the attributes of short and long-term biological assets and concluded that both are relevant values to the market when measured at fair value. Nevertheless, Gonçalves et al. (2017) identified that the measurement of biological assets at fair value is relevant, especially in companies with higher disclosure levels. The authors emphasize that such relevance was observed for production biological assets, not identifying the same behavior for consumable biological assets, suggesting that investors do not recognize differences in the higher levels of disclosure for this type of asset.

A similar study also noted that adopting fair value altered stock pricing and therefore raised informational gains to investors, but no informational gains were found in the generation of future operating cash flows (Ferreira & Teixeira, 2018). He (Colly) et al. (2018) also concluded that measuring biological assets at fair value is not relevant for predicting future operating cash flows, either by the active market or discounted cash flow techniques.

The absence of an active market for measuring the fair value of biological assets and the possibility of adopting the discounted cash flow method allows managers to manage results. Silva et al. (2015) warn that this scenario inserts greater discretion to managers and preparers of financial statements, which may affect the quality of accounting information, besides generating questions from users about the fair and appropriate view of accounting numbers.

The evidence from these studies confirms what was anticipated by Elad and Herbohn (2011). When analyzing the measurement and disclosure practices of biological assets in the annual reports of entities from Australia, France, and the UK, the authors identified that historical cost is the most common measurement basis, but several proxies, such as net present value, valuation by an external expert, net realizable value, and market price measure that fair value. According to the authors, these results show that IAS 41 has failed to promote comparability of accounting practices in the agricultural sector, potentially resulting in international differences in the quality of earnings in this sector.

Given the above, it is assumed that the method of measuring biological assets affects the quality of earnings of companies that explore agricultural activities.

The decision to use a particular measurement method can impact the quality of earnings (Francis et al., 2006; Dechow et al., 2010). Therefore, studying the effects of adopting different measurement methods on quality of earnings is vital since higher-quality earnings provide valuable information about company performance for decision-making (Dechow et al., 2010).

According to Martins et al. (2014), adopting the method of measuring biological assets involves several options that may result in different forms of valuation for the same asset, providing different values. Thus, considering: i) that there is no consensus on the use of the most appropriate method to measure these assets (Argilés et al., 2011); ii) the assumption that the use of different methods for measuring biological assets may result in differences in the quality of earnings of companies operating in the agricultural sector (Elad & Herbohn, 2011); iii) that the quality of earnings depends on the reporting decisions of managers (Francis et al., 2006) and the accounting system that measures it (Dechow et al., 2010), the following hypothesis was developed for this research: **the adoption of fair value to measure biological assets improves the quality of earnings, concerning the cost method**.

## 3 Methodological Procedures

Accounting and financial data for fiscal years from 2009 to 2017 were collected on the *Thomson Reuters Eikon*® platform. The 2009 data was explicitly used to collect observations of operating cash flows to calculate quality of earnings. While the adoption of IFRS has occurred at different periods worldwide, this sample period comprises the consolidation of the development and changes made to IAS 41.

For the population, this study has publicly traded companies that explore biological assets. In the Screener environment of the *Thomson Reuters Eikon*® platform, filters were applied to identify a sample of companies with balances in the groups Natural Resources - Gross; Property/Plant/Equipment, Total - Net; Inventories - Other; and Other Property, Plant, Equipment - Net. The analytical balances of Consumable Biological Assets and Production are conventionally grouped in these synthetic accounts.

Based on this criterion, through the *DataStream* environment, 832 companies were identified that reported figures on biological assets in the biological assets accounts of current assets, WC18258 - Biological Assets Current, and non-current assets, WC18277 - Biological Assets NBV. We excluded 147 companies with balances of less than US$ 1,000.00 (one thousand dollars), as these values were considered insignificant. In order to identify a sample that exploited biological assets continuously, 397 companies that did not report balances of these assets in at least four periods were excluded. Finally, to ensure the standardization of the observations and variables, 60 companies that did not present complete information to calculate the quality of earnings and four other companies considered outliers were eliminated. Thus, the research sample comprises 228 companies that met the selection criteria. These

companies were listed in 39 countries that required the IFRS standard throughout the analysis period from 2010 to 2017 (Table 1).

Table 1
**Sampling**

| Continent \| Listing Country | Year of IFRS adoption | Total | Continent \| Listing Country | Year of IFRS adoption | Total |
|---|---|---|---|---|---|
| United Kingdom | 2005 | 16 | South Africa | 2005 | 12 |
| France | 2005 | 8 | New Zealand | 2005 | 9 |
| Norway | 2005 | 8 | Morocco | 2008 | 2 |
| Poland | 2005 | 7 | Malawi | 2005 | 1 |
| Germany | 2005 | 6 | Namibia | 2005 | 1 |
| Spain | 2005 | 6 | Kenya | 2005 | 1 |
| Bosnia and Herzegovina | 2006 | 5 | Zambia | 2005 | 1 |
| Finland | 2005 | 4 | **Africa total** | | **27** |
| Latvia | 2005 | 4 | Chile | 2009 | 27 |
| Portugal | 2005 | 3 | Brazil | 2010 | 16 |
| Sweden | 2005 | 3 | **South America total** | | **43** |
| Belgium | 2005 | 2 | Hong Kong | 2005 | 34 |
| Greece | 2005 | 2 | Philippines | 2005 | 8 |
| Lithuania | 2005 | 2 | Turkey | 2005 | 4 |
| Luxembourg | 2005 | 2 | Pakistan | 2006 | 3 |
| Rep. of Serbia | 2005 | 2 | Oman | 2005 | 2 |
| Croatia | 2005 | 1 | Qatar | 2005 | 1 |
| Denmark | 2005 | 1 | Israel | 2008 | 1 |
| Iceland | 2005 | 1 | Kuwait | 2008 | 1 |
| Italy | 2005 | 1 | **Asia total** | | **54** |
| Romania | 2005 | 1 | Australia | 2005 | 19 |
| **Europe total** | | **85** | **Oceania total** | | **19** |
| **Sample total** | | | | | **228** |

Source: Elaborated by the authors based on *Thomson Reuters Eikon*®, IFRS (2019), and IAS Plus (2019).

IAS 41 establishes that gains or losses arising from the change in fair value less selling expenses of biological assets between the beginning and the end of the period should be recognized on the accrual basis and shown in the income statement. Some studies cite that gains and losses are recognized in different groups in the Income Statement, such as Operating Revenue or Cost of Goods Sold, or even Other Operating Income/Expenses. Nevertheless, the variations in the fair value of biological assets do not characterize a transfer of control, risks, and benefits of this asset, not justifying the use of the Operational Income account. Besides, the appropriation of these variations in the Cost of Goods Sold is incorrect since the asset was not sold then. In turn, the classification as Other Operating Income/Expenses is inappropriate since the distinction between operating and non-operating results is in disuse (Figueira & Ribeiro, 2015; Salotti & Santos, 2015).

Most companies that measure biological assets at fair value record such changes in items called Net Change or Adjustment in the Fair Value of Biological Assets or Gain or Loss in the Fair Value of Biological Assets. Demonstrating the variations in the fair value of biological assets in a specific account provides greater transparency of the information reported and assists the user of the information in the decision-making process (Figueira & Ribeiro, 2015).

The standardization of the variable Measurement of Biological Assets (MBA) followed the measurement criteria and subsequent disclosure through the item WC18573 - Unrealized Valuation Gains/Losses Biological Assets, available in the *DataStream* environment of the *Thomson Reuters Eikon*® platform. Thus, if the company reported information on gains or losses on the measurement of biological assets, it was assigned 1=fair value; if the company did not report information on gains or losses on biological assets, it was assigned 0=historical cost. This standardization ensures the classification of the companies in the sample that comply with IAS 41, which minimizes the possible error of accounting for variations in the fair value of biological assets by preparers of financial statements.

In the analysis period, the proportion of the adoption of Fair Value by company *i* was used to make the explanatory variable MBA compatible with the dependent variable Quality of Earnings (QE).

Earnings reflect the cash flows projected by firms (Dechow et al., 1998). The measure of accruals quality developed by Dechow and Dichev (2002), a proxy for quality of earnings, is based on the function of accruals in period $t_0$ on the realized operating cash flows in periods $t_{-1}$, $t_0$, and $t_{+1}$, which requires at least eight years of data to obtain six firm-specific regression residuals. The residuals represent estimation errors and are not related to the realized operating cash flows. A higher standard deviation of these residuals denotes a lower quality of earnings.

The quality of accruals is a measure based on the view that earnings that approximate operating cash flows are of better quality (Francis et al., 2006). Thus, to measure the quality of earnings, Equation 1 was adjusted, whose variables are deflated by average total assets (Dechow & Dichev, 2002).

$$ACC_{i,t} = \beta_0 + \beta_1 OCF_{i,t-1} + \beta_2 OCF_{i,t} + \beta_3 OCF_{i,t+1} + \varepsilon_t \quad (1)$$

Where:
$ACC_{i,t}$ = Accruals by the cash flow approach of company *i* in year *t*
$OCF_{i,t-1}$ = Operating cash flows of company *i* in year $t_{-1}$
$OCF_{i,t}$ = Operating cash flows of company *i* in year *t*
$OCF_{i,t+1}$ = Operating cash flows of company *i* in year $t_{+1}$
$\varepsilon_{i,t}$ = Estimation error of accruals of company *i* in year *t*

In the preliminary estimation procedure of the Ordinary Least Squares (OLS) multiple linear regression, the results of Equation 1 presented data with asymmetric distribution, according to the result of the Shapiro-Wilk test. As a corrective measure, we decided to perform a logarithmic transformation, standardizing the quality of earnings based on the logarithm of the standard deviation of the residuals.

In addition, based on the literature, factors related to asset measurement that may also explain the quality of earnings were added to the model as control variables. Table 2 presents the estimation metrics and the reference studies supporting the variables. For example, biological asset intensity, ownership concentration, and company size influence the mandatory disclosure of biological assets (Gonçalves & Lopes, 2014).

The statistical model was developed based on the probable theoretical relationships between the independent variable and control variables with the dependent variable. Thus, based on the assumptions presented in section 2 and the operational definition of the variables shown in Table 2, the following model was used to perform the test employing multiple linear regression:

$$QE_i = \beta_0 + \beta_1 MBA_i + \beta_2 COUNTRY_i + \beta_3 SECTOR_i + \beta_4 BIG4_i + \beta_5 STATUS_i + \beta_6 SHARE_i + \beta_7 SIZE_i + \beta_8 FLE_i + \beta_9 MTB_i + \beta_{10} PROFIT_i + \beta_{11} REPR_i + \beta_{12} CONS_i + \beta_{13} PROD_i + \varepsilon_i \quad (2)$$

The tests were performed in the free statistical software R (R Development Core Team), version 3.3.1.

Table 2
**Research Variables**

| Variable (Abbrv.) | Metric | Reference |
|---|---|---|
| | Dependent Variable | |
| Quality of Earnings (QE) | Quality of accruals of company *i*, by the cash flow approach, obtained by the logarithm of the standard deviation of the residuals of equation 1. | Dechow and Dichev (2002). |
| | Independent Variable | |
| Measurement of Biological Assets (MBA) | Proportion of the adoption of the Fair Value of company *i*, in the analysis period, obtained by the item (WC18573 - Unrealized Valuation Gains/Losses Biological Assets). It varies from 0 to 1. | Elad and Herbohn (2011). |
| | Control Variables | |
| Listing Country (COUNTRY) | Average Regulatory Quality of the Listing Country of company *i*, over 2009 to 2016. Ranges from -2.5 (*low*) to 2.5 (*high*) (Worldwide Governance Indicators). | Elad (2004), Demaria and Dufour (2007), Elad and Herbohn (2011). |
| Operating Sector (SECTOR) | Dummy variable: 0=Other, 1=Agribusiness. | Demaria and Dufour (2007), Collin et al. (2009). |
| Big Four (BIG4) | Proportion of balance sheets audited by Big Four (EY, Deloitte, KPMG, and PwC) of company *i*, in the analysis period. It varies from 0 to 1. | Collin et al. (2009), Elad and Herbohn (2011), Nogueira and Pires (2017). |
| Listing Status (STATUS) | Dummy variable: 0=Host and listing country are the same; 1=Host and listing country are different. | Demaria and Dufour (2007). |
| Shareholding Concentration (SHARE) | Average of the Minority Shareholders' Interest Index on the Total Capital % (shareholding concentration) of company *i* in the analysis period. | Demaria and Dufour (2007), Collin et al. (2009), Gonçalves and Lopes (2014), Tortoli et al. (2018). |
| Company Size (SIZE) | Average of the natural logarithm of the total assets of company *i* in the analysis period. | Watts and Zimmerman (1990), Dechow and Dichev (2002), Demaria and Dufour (2007), Gonçalves and Lopes (2014), Nogueira and Pires (2017), Tortoli et al. (2018). |

| Variable (Abbrv.) | Metric | Reference |
|---|---|---|
| Financial Leverage (FLE) | Average of the Financial Leverage Index (total liabilities/equity) of company *i* in the analysis period. | Watts and Zimmerman (1990), Demaria and Dufour (2007), Quagli and Avallone (2010), Pinto et al. (2015). |
| Market-to-Book (MTB) | Average of the Market-to-Book Ratio (market value/book value) of company *i* in the analysis period. | Quagli and Avallone, (2010) and Pinto et al. (2015). |
| Profitability (PROFIT) | Average of the Profitability Index (net income/net equity) of company *i* in the analysis period. | Watts and Zimmerman (1990) and Argilés-Bosch et al. (2017). |
| Representation of Biological Assets (REPR) | Average of the Representativeness Index of the Biological Assets (biological assets/total assets) of company *i* in the analysis period. | Gonçalves and Lopes (2014), Argilés-Bosch et al. (2017), Nogueira and Pires (2017), Tortoli et al. (2018). |
| Consumable Biological Assets (CONS) | Proportion of years with book balance in the consumable biological assets group (WC18258 - Biological Assets Current) of company *i*. It varies from 0 to 1. | Huffman (2018). |
| Production Biological Assets (PROD) | Proportion of years with book balance in the biological assets of production group (WC18277 - Biological Assets NBV) of company i. It varies from 0 to 1. | Huffman (2018). |

Source: Elaborated by the authors.

## 4 Results and Discussion

### 4.1 Presentation of Results

As a starting point for the analysis of the results obtained, descriptive statistics are presented to get an overview of the characteristic of the independent and control variables in the model (Table 3).

Table 3
**Descriptive Statistics**

| Variable | n | Mean | Standard Deviation | Min. | Max. | 1st Quartile | Median | 3rd Quartile | Coefficient of Variation |
|---|---|---|---|---|---|---|---|---|---|
| MBA | 228 | 0.42 | 0.40 | 0.00 | 1.00 | 0.00 | 0.38 | 0.78 | 95.38 |
| COUNTRY | 228 | 1.17 | 0.76 | -0.70 | 1.97 | 0.43 | 1.45 | 1.81 | 65.19 |
| SECTOR | 228 | 0.81 | 0.40 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 49.01 |
| BIG4 | 228 | 0.68 | 0.44 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 65.03 |
| STATUS | 228 | 0.13 | 0.33 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 262.53 |
| SHARE | 228 | 3.38 | 12.88 | -145.24 | 50.58 | 0.00 | 0.45 | 4.09 | 381.66 |
| SIZE | 228 | 20.15 | 1.83 | 14.44 | 24.91 | 19.08 | 20.02 | 21.26 | 9.08 |
| FLE | 228 | 2.28 | 11.61 | -32.36 | 155.74 | 0.60 | 1.03 | 1.69 | 508.51 |
| MTB | 228 | 1484.70 | 12801.31 | 0.07 | 185731.05 | 2.08 | 6.42 | 44.45 | 862.21 |
| PROFIC | 228 | 0.05 | 0.57 | -5.31 | 3.65 | 0.01 | 0.07 | 0.13 | 1108.08 |
| REPR | 228 | 0.12 | 0.15 | 0.00 | 1.00 | 0.01 | 0.06 | 0.16 | 126.11 |
| CONS | 228 | 0.61 | 0.49 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 80.93 |
| PROD | 228 | 0.84 | 0.37 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 44.11 |

Source: Research data.

Next, through Pearson's correlation matrix, it is observed that, except for profitability and leverage variables, which showed a negative correlation (-0.852), the other variables showed values lower than 0.5, which denotes the absence of multicollinearity in the model (Table 4).

Table 4
**Correlation matrix of the model's independent variables**

| | MBA | COUNTRY | SECTOR | BIG4 | STATUS | SHARE | SIZE | FLE | MTB | PROFIT | REPR | CONS | PROD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAB | 1.000 | | | | | | | | | | | | |
| COUNTRY | 0.276 | 1.000 | | | | | | | | | | | |
| SECTOR | 0.159 | -0.003 | 1.000 | | | | | | | | | | |
| BIG4 | 0.033 | 0.061 | -0.134 | 1.000 | | | | | | | | | |
| STATUS | 0.317 | 0.196 | 0.120 | -0.203 | 1.000 | | | | | | | | |
| SHARE | 0.043 | 0.038 | -0.058 | -0.031 | 0.003 | 1.000 | | | | | | | |
| SIZE | 0.024 | -0.080 | -0.180 | 0.386 | -0.187 | 0.188 | 1.000 | | | | | | |
| FLE | 0.021 | -0.037 | 0.018 | -0.049 | 0.074 | 0.025 | -0.002 | 1.000 | | | | | |
| MTB | 0.131 | -0.042 | 0.035 | -0.010 | 0.227 | -0.022 | -0.024 | -0.024 | 1.000 | | | | |
| PROFIT | -0.079 | -0.048 | -0.009 | 0.147 | -0.067 | 0.055 | 0.114 | -0.852 | 0.045 | 1.000 | | | |
| REPR | 0.289 | 0.240 | 0.081 | -0.025 | 0.067 | 0.035 | -0.030 | -0.061 | 0.021 | 0.028 | 1.000 | | |
| CONS | 0.110 | 0.052 | 0.171 | -0.115 | 0.060 | 0.058 | -0.115 | 0.081 | -0.021 | -0.093 | 0.059 | 1.000 | |
| PROD | 0.098 | -0.008 | -0.001 | 0.168 | 0.089 | -0.052 | 0.146 | 0.016 | -0.005 | -0.008 | 0.059 | -0.349 | 1.000 |

Source: Research data.

The Variance Inflation Factor (VIF) statistic was also evaluated, which quantifies the increase in the variance of each regression coefficient caused by multicollinearity, with none of the independent variables presenting VIF higher than 5, the base value for the cutoff point (Fávero et al., 2009).

It is necessary to verify the effect of the control variables that can affect the quality of earnings to ensure that the results obtained based on equation 1 result predominantly from the measurement method. Thus, Equation 2 was estimated, and the results are shown in Table 5.

Table 5
**Influence of the Accounting Method for the Measurement of Biological Assets and Control Variables on the Quality of Earnings**

| Variable | N | Estimate | Standard Error | T Value | p-Value |
|---|---|---|---|---|---|
| MBA | 228 | 0.876 | 0.219 | 3.992 | 0.000 |
| COUNTRY | 228 | 0.085 | 0.111 | 0.773 | 0.441 |
| SECTOR | 228 | -0.239 | 0.199 | -1.198 | 0.232 |
| BIG4 | 228 | -0.761 | 0.198 | -3.838 | 0.000 |
| STATUS | 228 | -0.062 | 0.296 | -0.209 | 0.835 |
| SHARE | 228 | -0.010 | 0.006 | -1.744 | 0.083 |
| SIZE | 228 | -0.132 | 0.047 | -2.790 | 0.006 |
| FLE | 228 | -0.025 | 0.026 | -0.976 | 0.331 |
| MTB | 228 | 0.000 | 0.000 | 0.442 | 0.659 |
| PROFIT | 228 | -0.259 | 0.271 | -0.957 | 0.340 |
| REPR | 228 | 1.551 | 0.534 | 2.901 | 0.004 |
| CONS | 228 | 0.007 | 0.170 | 0.043 | 0.966 |
| PROD | 228 | -0.157 | 0.235 | -0.668 | 0.505 |

$F(13.185) = 6.983$ (p-value < 0.001)
Adjusted $R^2 = 0.282$
Source: Research data.

According to the results of the F-test, the estimated model was significant at the 5% significance level (p-value < 0.001). The adjusted $R^2$ value (0.282) was considered sufficient to test the significance of the independent and control variables and the intensity of their associations with the dependent variable.

The data presented in Table 5 shows that there is statistical evidence that the variables MBA, BIG4, SIZE, and REPR affect the quality of earnings since they presented coefficients with values considered significant at a 5% significance level. It is noteworthy that, as previously reported, a lower standard deviation of the residuals of equation 1 denotes a better quality of earnings. Thus, the estimates presented in Table 5, resulting from equation 2, demonstrate that the measurement of biological assets at fair value and a higher representativeness of these assets in relation to total assets negatively influence the quality of earnings. In contrast, being a large company and being audited by a large auditing firm are conditions that improve the quality of earnings. The variables COUNTRY, SECTOR, STATUS, SHARE, FLE, MTB, PROFIT, CONS, and PROD did not show statistically significant data.

The results reveal that the adoption of fair value to measure biological assets has, on average, a standard deviation of the residuals of 0.876 units higher concerning the historical cost. This denotes that measuring biological assets at fair value negatively affected the quality of earnings compared to the cost method.

### 4.2 Analysis and Discussion of the influence of the Measurement of Biological Assets method on the Quality of Earnings

The results reveal that measuring biological assets at fair value resulted in a lower quality of earnings compared to historical cost. This evidence corroborates the findings of He (Colly) et al. (2018), where fair value did not provide incremental predictive power for future operating cash flows. The result of the present study is consistent with the assumption raised by Elad and Herbohn (2011) that different accounting practices used in agricultural activity to measure biological assets can lead to differences in the quality of earnings in this sector.

The historical cost was presented as the best method for estimating future cash flows of operating activities of companies that explore agricultural activities. The alternative view can also support this finding of fair value presented by Whittington (2008), who, considering an uncertain world with relatively imperfect and incomplete markets, states that the reliability of entity-specific measurements is an essential characteristic of financial reports. In this view, the author explains that as an input for forecasting future cash flows, the cost method can be a relevant measurement basis.

Therefore, the findings obtained in this paper suggest that the historical cost method's verifiability and reliability are important features that can improve estimates of future cash flows. Shivakumar (2013) explains that this is because accounting information based on historical cost records only information about realized cash flows. From this perspective, Watts (2003) argues that earnings should be recognized when there is evidence that they are verifiable and will be realized. Ronen (2008) points out that although market forces determine future cash flows, the best source of information about them should be the company itself.

In the case of fair value, Argilés et al. (2012) explain that the main disadvantage is when there is no active market for biological assets. Considering the absence of an active market, additional explanations for

the low quality of earnings of the companies that used fair value to measure biological assets can be supported by the arguments of Elad and Herbohn (2011), in which the determination of the discount rate to calculate the present value of the expected cash flows involves judgments and assumptions. The authors emphasize that these calculations are usually performed by independent external appraisers who do not always provide objective estimates.

On this aspect, Shivakumar (2013) emphasizes that including transitory gains and losses in income statements increases the dependence on estimates and requires judgment. Such reliance has the potential for misusing fair value estimates, thereby diminishing the relevance of the reported accounting numbers. Subjective gains and losses may provide little information about the company's ability to generate future cash flows at the level expected by stakeholders.

Following this logic, Ronen (2008) points out that using discounted cash flow to obtain the fair value is subject to random errors once they are not observable and are determined subjectively by company managers. The author emphasizes that the improper use of models to estimate fair value and measurement errors can compromise the accuracy of estimates, causing distortions in financial statements.

Measuring biological assets is not a simple task. These assets are living plants and animals that undergo biological transformations, and the fair value measurement process can be affected by some factors, such as dependence on soil and climate conditions, disease risks, and seasonal production and market characteristics (Dvořáková, 2006). With this, such factors, when not predictable or mitigable, can affect the judgment of preparers or significantly impact the financial position and performance of entities by inserting unrealized results that were previously measured based on fair value.

Notably, the cost method also has problems with subjectivity in the measurement process. For example, the historical cost would have problems accurately portraying the value of a newborn lamb or a bushel of wheat, i.e., measuring these assets at historical cost could be costly and produce numbers of dubious relevance (Elad, 2004).

Although the cost measurement model cannot absorb the value-generation process of biological transformations, it may be immune to the recognition of fictitious gains and losses that influence the decision-making process in situations involving the uncertainties of agricultural activities (Dvořáková, 2006). From this point of view, Huffman (2018) argues that investment analysts often remove the fair value of productive biological assets and the related unrealized gains or losses. Such an exercise can also be performed by other stakeholders, making the decision-making challenge of measuring biological assets at fair value innocuous.

Another explanation for the low quality of earnings is that the accruals resulting from measuring the fair value of biological assets by the discounted cash flow are susceptible to earnings management, which causes adverse effects on the quality of earnings (Silva et al., 2015). The choice of managers to report their estimates through fair value is not always substantiated, with the potential to signal stakeholders their expectations about future operating cash flows.

In sum, the main finding of this study did not confirm the hypothesis that the adoption of fair value to measure biological assets improves the quality of earnings about the cost method. On the contrary, the evidence indicates that the fair value method produced adverse effects on this quality compared to the cost method.

### 4.2.1 Analysis of the control variables that influence the Quality of Earnings

With the insertion of the control variables used in the research to analyze the quality of earnings, it can be seen that the effect of the measurement of biological assets seems to be minimized when the company is audited by a big four. The results suggest that the audit process exercised by a large auditing firm results in more informative accruals that, consequently, promote an improvement in the quality of earnings. It seems reasonable that the fact that the company is audited by a big four acts as enforcement for improved accounting information on accruals and earnings. Dechow et al. (2010) emphasize that companies audited by big audit firms present higher-quality accounting information.

It was found that larger companies tend to have higher quality of earnings. Larger firms have greater exposure and tend to be more transparent in their projections about future cash flows, thus reducing informational asymmetry between managers and investors. This result corroborates Dechow and Dichev's (2002) statement that large firms are more diversified, stable, and predictable in their operations, resulting in better accruals estimates and hence better quality of earnings.

If the variables Big Four and Size mitigate the effect of the measurement method on the quality of earnings, it was found that the variable Representativeness of Biological Assets negatively affects the quality of earnings. This result suggests that higher representativeness of biological assets requires investments in operational or administrative controls that require more significant efforts from companies that explore agricultural activities. The evidence suggests that these efforts were insufficient to obtain more informative accruals resulting from the biological assets measurement process, and consequently, asset-intensive companies are prone to present lower quality of earnings.

## 5 Final Considerations

This research aimed to identify the influence of the measurement method of biological assets on the quality of earnings. A sample of 228 non-financial companies listed in 39 countries, whose data were reported from 2009 to 2017, were analyzed. The results did not confirm the hypothesis raised in the study. The evidence pointed out that fair value, as a measurement method, negatively affected the quality of earnings compared to historical cost.

From the point of view of analysts, investors, and creditors, the evidence presented in this study suggests the need to analyze the accounting method used to measure biological assets in the decision process. Historical information about the quality of earnings derived from different methods of measuring biological assets may reflect a company's ability to distribute dividends and its potential to settle its financial obligations in subsequent periods.

For the preparers of financial statements, the research results suggest the need to analyze the methodology that best reflects the economic situation of biological assets. Furthermore, the results suggest that companies may be evaluated differently depending on the measurement methods and the amount of information available about them, such as the existence of different pricing policies for agricultural products, which introduce more significant uncertainty in measuring the fair value of biological assets.

Moreover, the results suggest that (a) the fact that the company is audited by a big four is an incentive to improve accounting information about accruals and earnings; (b) big companies are more predictable and transparent in their projections about future cash flows; (c) the operational or administrative controls used in companies with a high representativeness of biological assets were not sufficient to obtain more informative accruals. Thus, in addition to measuring biological assets, these factors are indicative to decision-makers who seek more reliable information about the realization of current accruals in operating cash flows in the subsequent period.

As a theoretical contribution, this study advances the debate over the measurement method for biological assets, notably by including the quality of earnings in discussions involving the relevance of fair value and the reliability of historical cost. Besides being helpful to stakeholders, these practical and theoretical contributions can alert regulators to the need for further improvements in IAS 41 to minimize the adverse effects on the quality of earnings resulting from measuring biological assets at fair value.

Such bodies should consider the need to ensure that the measurement process represents a fair and accurate view of biological assets. In addition, this research highlights the need for standard-setting bodies to intensify efforts to reduce differences in the interpretation of the standard at the international level to improve the trade-off between the relevance and reliability of accounting numbers resulting from different measurement methods.

The research findings also indicate that maintaining the use of the historical cost method represents a "safe harbor" for the preparers of financial statements. This evidence should stimulate the academic community in the discussion to reassess the teaching methodology of the standards derived from the IASB. Also, it highlights the need to expand the studies in search of methods that ensure reliability in measuring fair value, reducing the resistance to its use, both by the preparers and by the users of accounting information.

Some limitations should be noted in reading the results of this research and may alter the study results. The sample selection did not consider the stage and experience of IAS 41 adoption by different countries. This condition may affect both the learning curve and the interpretation of the standard.

Measuring the quality of earnings is inherently difficult; choosing the measure developed by Dechow and Dichev (2002) may capture only one characteristic of reported quality of earnings. According to Francis et al. (2006) and Dechow et al. (2010), the literature offers other proxies to measure the quality of earnings. Using other proxies can assist in analyzing both the quality of earnings and the economic and financial condition of the assets being measured.

Another limitation inherent to the methodology used in this study is related to the possibility of the same company having used the historical cost method and different hierarchical fair value levels (level 1, 2, and 3 inputs) simultaneously to measure different biological assets (consumable and productive), in different production and maturity cycles. Therefore, it was impossible to analyze the potential concomitant use of multiple accounting practices in measuring biological assets.

Future research can explore these limitations and fill these gaps. Furthermore, studies can advance on this theme, including other types of companies, such as agricultural cooperatives and closely-held companies, and compare the results presented here with the amendments to IAS 41 and IAS 16, which established the cost method to measure bearer plants.

## References

Argilés, J. M., García-Blandon, J., & Monllau, T. (2011). Fair value versus historical cost-based valuation for biological assets: predictability of financial information. *Revista de Contabilidad-Spanish Accounting Review RC-SAR*. 14(2), 87-113. https://doi.org/10.1016/S1138-4891(11)70029-2.

Argilés-Bosch, J. M., Aliberch, A. S., & García-Blandón, J. (2012). A comparative study of difficulties in accounting preparation and judgement in agriculture using fair value and historical cost for biological assets valuation. *Revista de Contabilidad-Spanish Accounting Review RC-SAR*. 15(1), 109-142. https://doi.org/10.1016/S1138-4891(12)70040-7.

Argilés-Bosch, J. M., Miarons, M., Garcia-Blandon, J., Benavente, C., & Ravenda, D. (2017). Usefulness of fair valuation of biological assets for cash flow prediction. *Spanish Journal of Finance and Accounting*. 24, 157-180. https://doi.org/10.1080/02102412.2017.1389549.

Aryanto, Y. H. (2011). Theoretical Failure of IAS 41 Agriculture. *The Indonesian Institute of Accountants*, 1-5. http://dx.doi.org/10.2139/ssrn.1808413.

Barlev, B., & Haddad, J. R. (2003). Fair value accounting and the management of the firm. *Critical Perspectives on Accounting*. 14(4), 383-415. https://doi.org/10.1016/S1045-2354(02)00139-9.

Dechow, P. M., & Dichev, I. D. (2002). The quality of accruals and earning: the role of accrual estimation erros. *The Accounting Review*. 77(4), 35-39. https://www.jstor.org/stable/3203324.

Dechow, P. M., Ge, W., & Schrand, C. (2010). Understanding earnings quality: a review of the proxies, their determinants and their consequences. *Journal of Accounting and Economics*. 50(2-3), 344-401. https://doi.org/10.1016/j.jacceco.2010.09.001.

Dechow, P. M., Kothari, S. P., & Watts, R. L. (1998). The Relation Between Earnings and Cash Flows. *Journal of Accounting and Economics*. 25(2), 133-168. https://doi.org/10.1016/S0165-4101(98)00020-2.

Demaria, S., & Dufour, D. (2007). *First time adopition of IFRS, Fair Value opition, Conservatism: Evidences from French listed companies*. 2007. https://halshs.archives-ouvertes.fr/halshs-00266189/document.

Dvořáková, D. (2006). Application of Fair Value Measurement Model in IAS 41 – Relation between Fair Value Measurement Model and Income Statement Structure. *European Financial and Accounting Journal*. 1(2), 49-70.

Dvořáková, D. (2011). Fair Value Measurement in Financial Reporting. *European Financial and Accounting Journa*l. 6(1), 60-75. https://doi.org/10.18267/j.efaj.39.

Elad, C. (2004). Fair value accounting in the agricultural sector: some implications for international accounting harmonization. *European Accounting Review*. 13(4), 621-641. https://doi.org/10.1080/0963818042000216839.

Elad, C., & Herbohn, K. (2011). *Implementing fair value accounting in the agricultural sector*. The Institute of Chartered Accountants of Scotland. T. Great Britain: J. International Ltd.

Fávero, L.P., Belfiore, P., Silva, F. L., & Chan, B. L. (2009). *Análise de Dados: modelagem multivariada para tomada de decisões*. Rio de Janeiro: Elsevier.

Ferreira, R. A., & Teixeira, A. (2018). A relevância das informações financeiras nas empresas listadas na B3 que atuam com ativos biológicos após adoção do CPC 29. *Revista de Gestão, Finanças e Contabilidade*. 8(2), 5-22. https://doi.org/10.18028/rgfc.v8i2.5481.

Figueira, L. M., & Ribeiro, M. S. (2015). Análise da evidenciação sobre a mensuração de ativos biológicos: antes e depois do CPC 29. *Revista Contemporânea de Contabilidade*. 12(26), 73-98. https://doi.org/http://dx.doi.org/10.5007/2175-8069.2015v12n26p73

Francis, J., Olsson, P., & Schipper, K. (2006). Earnings quality. *Foundations and Trends in Accounting*. 1(4), 259-340. http://dx.doi.org/10.1561/1400000004.

Gonçalves, R., & Lopes, P. (2014). Firm-specific determinants of agricultural financial reporting. *Procedia-Social and Behavioral Sciences*, 110, 470-481. https://doi.org/10.1016/j.sbspro.2013.12.891

Gonçalves, R., Lopes, P., & Craig, R. (2017). Value relevance of biological assets under IFRS. *Journal of International Accounting, Auditing and Taxation*. 29, 118-126.http://dx.doi.org/10.1016/j.intaccaudtax.2017.10.001.

He, L. Y. (Colly), Wright, S., & Evans, E. (2018). Is fair value information relevant to investment decision-making: Evidence from the Australian agricultural sector? *Australian Jourrnal of Management*, 43(4), 555-574. https://doi.org/10.1177/0312896218765236

Herbohn, K., & Herbohn, J. (2006). International Accounting Standard (IAS) 41: What Are the Implications for Reporting Forest Assets? *Small-scale Forest Economics, Management and Policy*. 5(2), 175-189. https://doi.org/10.1007/s11842-006-0009-1.

Huffman, A. (2018). Asset use and the relevance of fair value measurement: evidence from IAS 41. *Review of Accounting Studies*. 23, 1274-1314. https://doi.org/10.1007/s11142-018-9456-0.

IAS Plus (2019). *Jurisdictions*. https://www.iasplus.com/en/jurisdictions.

International Accounting Standards Board (2018). IAS 41 *Agriculture*. http://eifrs.ifrs.org/eifrs/bnstandards/pt-br/2018/ias41.pdf.

International Financial Reporting Standards (2019). Use of IFRS Standards by Jurisdiction. https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/.

Lefter, V., & Roman, A. G. (2007). IAS 41 Agriculture: Fair Value Accounting. *Theoretical and Applied Economics*. 5(510), 15-22. https://econpapers.repec.org/article/agrjournl/v_3a5(510)_3ay_3a2007_3ai_3a5(510)_3ap_3a15-22.htm.

Martínez, J. A., Martínez, F. G., & Marín Diazaraque, J. M. (2011). Optional accounting criteria under IFRSs and corporate characteristics: evidence from spain. *Revista de Contabilidad*.14(1), 59-85. https://doi.org/10.1016/S1138-4891(11)70022-X.

Martins, V. G., Machado, M. A. V., & Callado, A. L. C. (2014). Relevância e representação fidedigna na mensuração de ativos biológicos a valor justo por empresas listadas na BM&FBovespa. *Revista Contemporânea de Contabilidade*. 11(22), 163-188. https://doi.org/10.5007/2175-8069.2014v11n22p163.

Nogueira, D. R., & Pires, P. A. S. (2017). Nível de Disclosure do CPC 29 Ativos Biológicos: Análise dos fatores determinantes nas companhias brasileiras. *Contabilidade, Gestão e Governança*. 20(1), 38-54. http://dx.doi.org/10.21714/1984-3925_2017v20n1a3.

Pinto, I., & Pais, M. C. (2015). Fair value accounting choice: Empirical evidence from Portuguese real estate investment funds. *Journal of European Real Estate Research*. 8(2), 130-152. https://doi.org/10.1108/JERER-09-2014-0032.

Pinto, M. J. T., Martins, V. A., & Silva, D. M. (2015). Escolhas contábeis: o caso brasileiro das propriedades para investimento. *Revista Contabilidade & Finanças*. 26(69), 274-289. https://doi.org/10.1590/1808-057x201512280.

Quagli, A., & Avallone, F. (2010). Fair Value or Cost Model? Drivers of Choice for IAS 40 in the Real Estate Industry. *European Accounting Review*. 19(3), 461-493. https://doi.org/10.1080/09638180.2010.496547.

Ronen, J. (2008). To Fair Value or Not to Fair Value: A Broader Perspective. Abacus – Journal Compilation. Accounting Foundation. *The University os Sydney*. 44(2), 181-208. https://doi.org/10.1111/j.1467-6281.2008.00257.x.

Salotti, B. M., & SANTOS, A. (2015). Ativos biológicos na DVA: análise da divulgação no Brasil. *Revista de Contabilidade e Organizações*. 9(23), 4-23. https://doi.org/10.11606/rco.v9i23.88025

Shivakumar, L. (2013). The role of financial reporting in debt contracting and in stewardship. *Accounting & Business Research*. 43(4), 362-383. https://doi.org/10.1080/00014788.2013.785683.

Silva Filho, A. C. C., Machado, M. A.V, & Machado, M. R. (2013). Custo histórico X valor justo: qual informação é mais value relevant na mensuração dos ativos biológicos? *Custos e @gronegócio on line*. 9(2), 27-50. http://www.custoseagronegocioonline.com.br/numero2v9/Custos%20historicos.pdf.

Silva, R. L. M., Nardi, P. C. C., & Ribeiro, M. S. (2015). Gerenciamento de Resultados e Valorização dos ativos biológicos. *Brazilian Business Review (BBR*). 12(4), 1-27. http://dx.doi.org/10.15728/bbr.2015.12.4.1.

Tortoli, J. P., Pires, P. A. S., Botelho, D. R., & Rech, I. J. (2018). Divulgação de ativos biológicos e concentração acionária nas empresas brasileiras do agronegócio. *Revista de Contabilidade e Organizações*. 12(e144885), 1-18. https://doi.org/10.11606/issn.1982-6486.rco.2018.144885.

Watts, R. L. (2003). Conservatism in Accounting Part I: Explanations and Implications. *Accouting Horizons*. 17(3), 207-221. https://doi.org/10.2308/acch.2003.17.3.207.

Watts, R. L., & Zimmerman, J. L. (1990). Positive accounting theory: a ten year perspective. *The Accounting Review*. Englewood Cliffs, 65(1), 131-156. https://ssrn.com/abstract=928701.

Whittington, G. (2008). Fair value and the IASB/FASB conceptual framework project: an alternative view. *Abacus*. 44(2), 139-178. https://doi.org/10.1111/j.1467-6281.2008.00255.x.

Worldwide Governance Indicators (2018). *Regulatory Quality.* http://info.worldbank.org/governance/wgi/#home.

## NOTES

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Data collection: M. P. R. Souza
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Does not apply.



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