The (in) difference of measuring biological assets: a cross-country study

DOI: 10.4025/enfoque.v45i2.71076

Ricardo Luiz Menezes da Silva
PhD in Accounting at School of Economy, Business Administration and Accounting - University of Sao Paulo
Associate professor
E-mail: rlms@fearp.usp.br

Paula Carolina Ciampaglia Nardi
PhD in Organization Administration - University of Sao Paulo
Associate professor
E-mail: paulanardi@fearp.usp.br

Recebido em: 24.01.2024 Aceito em: 22.04.2024 2ª versão aceita em: 11.09.2024

ABSTRACT

Purpose: in this paper, we investigated the value relevance of biological assets and their variation at fair value, considering the differences between countries in terms of their legal systems: common law and code law.
Methodology: we looked at 377 companies from 58 countries, collecting information from Thomson Reuters and notes to the financial statements.
Relevance: the discussion of the measurement of bearer plants revealed that analysts and investors are still looking for improvements in the financial statements. The gap arises from the lack of studies on the measurement of biological assets in different legal systems. Furthermore, some studies have disclosed the low quality of accounting information issued in accordance with IAS 41 biological assets, raising doubts about the relevance of fair value measuring.
Results: the results revealed that the variation in the biological assets and in the fair value of those assets is irrelevant to the capital market, even after restricting the analysis to common law, monitored by analysts. Our results encourage greater discussion regarding biological assets, since the IAS 41 is still open to debate by investors and regulators with a view to improvements.
Contributions: From a practical point of view, our results reveal that information on biological assets may not be as useful for information users, including market analysts. Analysts have the role of providing information on the economic and financial performance of companies, helping to reduce information asymmetry between agents. In this sense, the question arises: are investors and analysts able to use information on biological assets appropriately to assess risk and prepare their estimates? Is this information relevant? Therefore, it is possible to visualize a relationship between the usefulness of accounting information and possible decisions to buy, sell or maintain investment in shares.

Keywords: IAS 41, biological assets, relevance, financial information, capital market.

A (in) diferença na mensuração de ativos biológicos: um estudo cross-country

RESUMO

Objetivo: neste artigo, nós investigamos a relevância dos ativos biológicos e a sua variação a valor justo, considerando as diferenças entre os países em termos de sistemas legais: *common law* e *code law*.
Metodologia: nós analisamos 377 empresas de 58 países, e coletamos informações da Thomson Reuters e notas explicativas das demonstrações contábeis.
Relevância: o tema mensuração de plantas portadoras mostra que analistas e investidores ainda buscam melhorias nas demonstrações contábeis. A lacuna corresponde à falta de estudos sobre a mensuração de ativos biológicos em diferentes sistemas legais. Além disso, alguns estudos revelam uma baixa qualidade das informações contábeis emitidas de acordo com a IAS 41 de ativos biológicos, levantando dúvidas sobre a relevância da mensuração a valor justo.
Resultados: os resultados revelam que a variação de ativos biológicos e do valor justo desses ativos é irrelevante para o mercado de capitais, mesmo após restringir a análise para países de origem *common law*, e também pelo monitoramento das empresas por analistas. Nossos resultados instigam uma maior discussão sobre ativos biológicos, uma vez que a IAS 41 ainda pode ser debatida por investidores e reguladores que buscam melhorias.

Contribuições: do ponto de vista prático, nossos resultados revelam que as informações sobre ativos biológicos podem não ser tão úteis para os usuários da informação, incluindo analistas de mercado. Os analistas têm o papel de fornecer informações sobre o desempenho econômico-financeiro das empresas, ajudando a reduzir a assimetria de informação entre os agentes. Nesse sentido, tem-se a pergunta: investidores e analistas conseguem utilizar as informações sobre ativos biológicos adequadamente para avaliar riscos e elaborar suas estimativas? Essas informações são relevantes? Portanto, é possível visualizar uma relação entre a utilidade das informações contábeis e possíveis decisões de compra, venda ou manutenção de investimento em ações.

Palavras-chave: IAS 41, ativos biológicos, relevância, informação financeira, mercado de capitais.

1 INTRODUCTION

Historically, there are differences in the Generally Accepted Accounting Principles (GAAP) adopted in several countries, but in recent decades, great efforts have been made to standardise some accounting standards, resulting in the adoption of a set of international accounting standards called the International Financial Reporting Standards (IFRS). Various incentives exist towards this end, particularly the need for investors to compare the financial

Statements of different countries (Ball, 2006). The need to develop the capital market and reassure investors made many countries adopt the IFRS in search of transparent and comparable financial statements (Daske et al., 2008). The convergence process towards the IFRS can enhance the quality of companies' financial statements and their accuracy in representing the economic-financial reality, resulting in information that is relevant for the capital market (Barth et al., 2008, Zeghal et al., 2012).

Nevertheless, to increase the relevance of accounting information, the standard setters are constantly discussing possible improvements in the standards to increase the relevance of accounting information. For example, the most recent document related to agricultural activities discusses the possibility of: i) increasing disclosure of the changes in the fair value of agricultural produce, and ii) measuring certain bearer animals similarly to bearer plants, for instance, breeding cattle (IASB, 2022).

Furthermore, discussion of the measurement basis is still a sensitive topic for biological assets, since the fair value has its enthusiastic supporters and opponents (Herbohn & Herbohn, 2006, Argilés-Bosch et al., 2012, He et al., 2018); also, fair value is discussed in a broader context (Goh et al., 2021). The debate is not recent. As early as 1997, the Farm Financial Standards Council (FFSC) released the non-GAAP Financial Guidelines for Agricultural Producers (FGAP) (Marsh & Fischer, 2013).

In this context, accounting transactions involving agricultural activities should receive greater attention, mainly because some accounting practices can hamper users' ability to assess entities' performances (Lewis & Jones, 1980). It is known that the scope of IAS 41 covers biological assets, which should be assessed at their fair value. Some biological assets have neither observable parameters nor an active market, though, raising doubts about the reliability of fair value measurements (Fisher et al., 2010).

These and other doubts about the IAS 41 have motivated some studies, revealing that the standard lacks further discussion, due to polemic aspects like the disclosure, valuation, and measurement of biological assets and agricultural products (Booth & Walker, 2003, Dvorakova, 2006, Herbohn, 2006, Williams & Wilmshurst, 2009, Fisher et al., 2010, Argilés-Bosch et al., 2011, Argilés-Bosch et al., 2012, Silva et al., 2015, Cavalheiro et al., 2017, Gonçalves et al., 2017, Oliveira et al., 2020).

In this context, we highlight the study of Huffman (2018), who investigated the relevance of fair value measurement, more specifically for in-exchange assets and in-use assets. The author found that earnings information is significantly more relevant when firms measure in-exchange biological assets at fair value. However, the study did not consider possible institutional differences between the 35 countries that could influence the quality of financial statements.

The literature about IFRS adoption highlights the importance of considering such differences; for example, according to Christensen et al. (2013), there are some reasons to analyse the announced benefits

of compulsory IFRS adoption cautiously: i) increasing discretion in the application of the new standards; ii) heterogeneity among the adopting countries in the functioning of the legal system and the enforcement level. The two aspects are consequences of the institutional differences between countries.

Another sign of some biological assets' low information quality is analysts and investors' efforts to change the standard, specifically the measurement of bearer plants – a subgroup of biological assets (IFRS, 2015). The result was a change in the accounting treatment of bearer plants, which started to be measured at their historical cost instead of their fair value, matching the accounting treatment of bearer plants to that of property, plant, and equipment. The changes were applied in January 2016.

Hence, considering the uncertainties associated with the quality of financial statements elaborated in accordance with IAS 41 and the recent changes in that standard, motivated by analysts and investors in search of improvements (IFRS, 2015), we present the following research problem: are biological assets and their variation at fair value relevant in different legal systems?

In this regard, the following research objective is presented: we investigated the value relevance of biological assets and their variation at fair value, considering the differences between countries in terms of their legal systems: common law and code law. Therefore, in this study, data from 377 companies and 58 countries were considered. The information was collected from Thomson Reuters Eikon and notes to the financial statements for the years 2014 and 2015.

Of the total group of companies analysed, the measurement method could not be identified for 45%. In fact, as reported in section 6, the disclosure remains very poor, as verified in the analysis of the notes to the financial statements of companies holding biological assets. Then, comparative analysis is impaired when companies from different countries are considered. Among the companies that provided information about the measurement base, the results reveal that 88% exclusively apply the fair value as the measurement base. The earnings quality was tested by means of value-relevance models, which indicated that the variation of biological assets at fair value and investments in biological assets are not value-relevant for the capital market, which is coherent with criticisms the standard received in previous years, until they resulted in the recent change in the IAS 41.

When restricting the analysis to common law companies monitored by analysts, the accounting information on biological assets is not value relevant, contrary to expectations. This result reveals that common law countries do not necessarily have biological asset information of higher quality. One explanation may be the significant role of civil law countries in agricultural activities, despite their average low protection of investors and creditors, lower enforcement level, and lower mean market capitalisation (La Porta et al., 1998). The data also reveal that 58% of companies studied come from civil law countries.

We contribute to the literature examining the quality of IAS 41 by showing empirical evidence regarding the value relevance of the fair value of biological assets, which can reinforce the debate regarding the measurement bases used in accounting. The case of bearer plants should be highlighted: their measurement was initially performed at fair value and then moved to historical cost, revealing an unprecedented change in the measurement base for assets; also, the standard setters sent a message to the capital market that the historical cost is more suitable for measuring bearer plants.

Our incremental contribution beyond what the prior literature has already documented is to study the relevance of biological assets, considering the differences between countries in terms of the legal system.

Finally, these results show that governments and regulatory agents should be concerned with the financial information disclosed in the capital market, as the irrelevance of the information in combination with low disclosure can increase the information asymmetry among market agents.

One aspect that regulators and stakeholders could discuss further is the disclosure of non-financial information in response to demand from some market analysts. In that sense, the accounting information could be more useful to elaborate forecasts, permitting a more appropriate risk assessment.

2 LEGAL SYSTEM AND ACCOUNTING INFORMATION QUALITY

The legal system of a country can be divided into Roman law (civil law) and common law. The first is usually practiced in countries that were under the influence of the Roman empire and France: France itself, Germany, Italy, Portugal, and Spain are the prime examples. The second system has been adopted in countries that were part of the British empire: the USA, Canada, Australia, New Zealand, Malaysia, and others. The main difference between the two systems is the origin and force of the laws.

In Roman law, the standards originate in the legal text, whereas in common law, the origin of the regulations is bound to customs and traditions. To give an example, Daske et al. (2008) observed some benefits deriving from the adoption of the IFRS in countries where legal enforcement is strong, with high-quality financial reporting, which are both characteristics of common law countries.

This means that the legal environment can influence both the process of adoption of the IFRS and the application of standards. In civil law countries, for example, there is a lack of legal protection granted to investors (La Porta et al., 1999). In this line, investors' willingness to allocate resources may decrease, leading to increases in the cost of equity for the companies.

According to La Porta et al. (1997), the norms and the degree of enforcement can contribute to development of the capital market, since a legal environment that offers protection to investors against the expropriation of wealth can attract more resources to companies, contributing to expansion of the capital market.

In addition, a study by Soderstrom and Sun (2007) summarises the aspects that influence the quality of accounting information, as illustrated below.

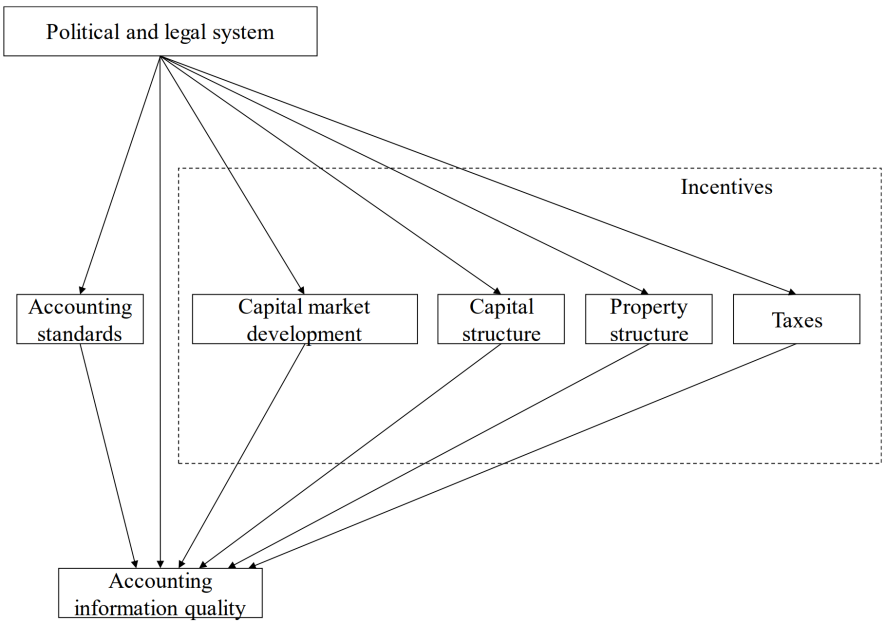

Figure 1. Determinants of accounting quality.
Source: Soderstrom and Sun, 2007.

Soderstrom and Sun (2007) note that the legal system represents a significant part of a country's institutional system, permeating the incentives that must be considered when investigating the disclosure of financial statements or, more specifically, the effects of adopting a standard, such as IAS 41 biological assets. Does this rule truly represent an increase in the informational content of the financial statements?

3 IAS 41 AND QUALITY OF FINANCIAL INFORMATION

IAS 41 applies to all companies with biological assets and agricultural production at the harvest point. Biological assets refer to all live animals and plants, which are the source of agricultural production – any product harvested based on biological assets. Although the standards permit the use of two measuring bases – fair value or historical cost – the use of the latter is becoming an exception.

Concerning the fair value, IFRS 13 Fair Value Measurement determines that the company should use valuation techniques appropriate to the circumstances and for which sufficient data are available to measure the fair value, maximising the use of relevant observable data and minimising the use of non-observable data.

In this situation, freedom of judgement is noteworthy in the application of the standard, aiming to appropriately reflect the result of the event or transaction. In addition, according to IFRS 13, the availability of relevant information and its relative subjectivity can influence the choice of appropriate valuation techniques. Nevertheless, without an active market, the manager can use non-observable data to price the asset, like in the case of the discounted cash flow, a scenario that is not really wanted, according to IFRS 13.

Hence, when a market value is unavailable for the biological assets, the company should use the present value of the expected net cash flow, discounted at the current market rate. All premises assumed in determining the fair value through this method should be disclosed.

By admitting the use of the fair value when no observable data exist, the manager is granted the responsibility to elaborate the discounted cash flow, using the elements that most adequately represent the expected future performance of the business, in which the discount rate and the period of the benefits can serve as relevant distinguishing factors. Hence, the manager can be more or less conservative in his projections – which by itself can influence the quality of the accounting information.

Nevertheless, the historical cost method can reduce the quality of the financial information for biological assets involving long terms and high maturation and production values. To give an example, companies in the paper and pulp industry have extensive forest growth areas that take many years to reach the cutting age. Therefore, the fair value concept can be more suitable, despite the questions raised in function of the subjectivity (Garcia et al., 2016).

Although accounting plays a fundamental role in attending to external users' information needs, based on Agency Theory (Jensen & Meckling 1976), it is known that managers have incentives not to disclose information that is coherent with the company's equity situation.

In that sense, the studies by Fisher et al. (2010), Argilés-Bosch et al. (2011), and Rech and Pereira (2012) highlight the risk of subjectivity and the possibility of earnings management in the application of IAS 41. These studies have explored the information content produced based on the change in the measuring base from the historical cost to the fair value. Some studies are displayed in the table below.

Table 1
"Research on IAS 41".

Author (s)	Country	Results
Booth and Walker (2003)	Australia	Mistaken assertions are possible and the relevance of accounting information can decrease.
Dvorakova (2006)	Czech Republic	There is some fear that the measuring is associated with fictitious gains, which would compromise the quality of the accounting information.
Herbohn (2006)	Australia	The author identified a range of methods adopted to determine the net market value of the biological assets.
Williams and Wilmshurst (2009)	Australia	Comparability is impaired in function of the discretion in the way biological assets are assessed.
Fisher et al. (2010)	New Zealand	Reliability in the recognition of unrealised gains and losses is questionable due to the range of premises.
Argilés-Bosch et al. (2011)	Spain	The authors did not find significant differences between historical cost and fair value valuation methods to assess future cash flows.
Rech and Pereira (2012)	Brazil	The valuation of biological assets at fair value is a subjective exercise.
Argilés-Bosch et al. (2012)	Spain	The perception of fair value is clearer than that of historical cost.
Silva et al. (2013)	Brazil	The disclosure of biological assets following the IAS 41 by publicly traded and privately held companies is weak.
Jana and Marta (2014)	Czech Republic	The companies' disclosures are in accordance with the changes for bearer plants.
Damian et al. (2014)	Comment letters from many countries	The authors concluded that some clarifications are still needed with regard to the change for bearer plants.
Silva et al. (2015)	Brazil	There are signs of greater earnings management for companies with biological assets assessed at fair value.
Daly and Skaife (2016)	28 countries	The cost of debt is higher for firms using the fair value method of accounting for their biological assets relative to firms using historical cost.
Gonçalves et al. (2017)	27 countries	Biological assets are relevant, mainly for companies with higher disclosure levels.
Huffman (2018)	35 countries	The fair value of biological assets implies information that is more useful for decision making when the assets possess value-in-exchange.

Source: Prepared by the authors

According to Machado et al. (2014), the fair value assessment model for biological assets has critical factors that can influence its validation, such as an active market. The authors conclude that the reliability of the model depends on the people involved, reinforcing that accounting is a process of social construction.

Otherwise, the study by Martins et al. (2014) identified that biological assets measured at fair value are value-relevant to the Brazilian capital market. Furthermore, according to the authors, these assets measured at fair value are seen by the market as faithful, that is, with faithful representation.

Figueira and Ribeiro (2016) found that the predominant method for valuing biological assets in Brazil is discounted cash flow, with a diversity in the use of discount rates, which can be explained, according to the authors, by technical uncertainty. Despite observing an increase in the information associated with biological

assets, this does not mean that this information is useful for the stakeholders since much information is disclosed to comply with IAS 41.

Also in Brazil, Cavalheiro et al. (2019) observed an association between accounting choices in the context of measuring biological assets and the profile of professionals, for example, more experienced professionals adopt more conservative and market-established techniques. The authors also report that there is no standardization of measurement techniques and procedures. In addition, Cavalheiro et al. (2019) presented an interdisciplinary methodological proposal focusing on agrometeorological modeling to evaluate sugar cane.

In an international context, the study by Morozova et al. (2019) identified that companies in the Eurasian Economic Union (EEU) apply different methods of valuing biological assets, making it difficult to compare financial statements. To avoid this difficulty, the authors suggest the development of unified approaches to the practice of evaluating biological assets.

In another study, Biljon and Wingard (2020) studied the biological assets of companies belonging to Brazil, Canada, South Africa, Australia, the United Kingdom, New Zealand, the Netherlands, Italy, Spain and the United States. In general, the authors observed non-compliance in the disclosure of biological assets about accounting rules and inconsistencies in the application of valuation methods. Furthermore, they found that only 40% of the cases analyzed used a market value valuation methodology.

According to He et al. (2021), managers can use fair value in measuring biological assets for earnings manipulation purposes, depending on the managers' level of discretion. According to the authors, boards of directors appear to understand this possibility of earnings manipulation, since executive remuneration is not based on gains arising from the fair value of biological assets.

Returning to the Brazilian context, Rabassi et al. (2020) studied the application of the biological assets standard in a sugarcane company in the State of São Paulo. The authors found that fair value changed the company's economic and financial indicators, resulting in possible changes in decision-making.

Oliveira and Nakao (2021) highlight that research on the measurement of biological assets presents mixed results regarding the value-relevance of accounting information, which may be motivated by discretion in measuring assets without market value. The authors also highlight that there is a need for further analysis to assess the fair value of biological assets.

Souza and Shikida (2021) studied the impact of amendments to IAS 16 and IAS 41 on the economic and financial position of Brazilian sugar-energy companies. In general, the authors reported that there was an improvement in current liquidity and asset turnover, there was also a negative impact on the participation of third-party capital, fixed assets, general liquidity, and return on equity.

Also in the context of sugar-energy companies, Silva et al. (2022) studied the fair value measurement model for sugar cane. The authors identified the possibility of material misstatements in the case of the incorrect use of a single assumption. According to the authors, there is still room for improvement in terms of accounting standards for biological assets.

Moutinho and Silva (2023) found a relationship between legal status and the fair value hierarchy of biological assets, reinforcing the difficulty for companies located in countries with lower legal status in obtaining reliable information to measure fair value. Furthermore, the authors reported an association between the biological asset measurement method and size. According to the authors, it was expected that larger companies would be more likely to use fair value. The study of Oliveira and Nakao (2023) identified problems in the comparability between companies that have biological assets.

The articles found in the literature present different results, indicating that there is space for discussion on IAS 41, mainly due to the use of the fair value, the disclosure quality, and the recent changes for the bearer plants. In recent years, however, the literature on earnings quality and the IFRS has shown that the implementation of the IFRS is heterogeneous among countries. The incentives towards disclosure depend on different factors, including the institutional environment (Daske et al., 2008, Ball et al., 2003, Ball, 2006,

Christensen et al., 2015). These and other aspects should be taken into account in research on the application of IAS 41.

4 RESEARCH HYPOTHESES

According to the previous sections, there are incentives in the market that lead to the underproduction of accounting information, which justifies the regulation of accounting.

Indications of asymmetric information among agents could cause the capital market to be efficient in the semi-strong form, opening room for distortions in share prices.

In addition, it is known that there are incentives to choose one accounting practice over another, generating possible benefits for the decision maker. That is the case of measuring the biological assets at fair value or cost, generating a research opportunity to investigate the relevance of the accounting information.

In this context, one must consider the institutional aspects of the countries studied, shaped by the legal and political environment, which can influence the information demand in the capital market and thus the quality of accounting information. Therefore, cross-country studies generally control firms according to the legal system, since differences between civil law and common law can influence the results. In addition, the greater monitoring by market analysts may reflect a demand for information on company performance, which, in turn, may direct the share price. Thus, these aspects can help to evaluate the relevance of the accounting information following IAS 41.

This standard has been discussed in the literature due to problems in the disclosure, evaluation, and measurement of biological assets and agricultural products, and some results regarding its usefulness are contradictory. Fair value is one of the most discussed points, but most studies are done by country. These studies reveal great concern with the implementation of fair value, especially for biological assets without an active market.

In the literature, there is unfavorable empirical evidence about the value-relevance of biological assets and their fair value (Booth & Walker, 2003, Dvorakova, 2006, Oliveira & Nakao, 2021) and favorable evidence (Martins et al., 2014, Gonçalves et al., 2017, Huffman, 2018, Silva & Nardi, 2023[1]), showing that further studies are necessary. Therefore, the following hypothesis is developed:

H_1: The accounting information following IAS 41 is relevant to the capital market.

Furthermore, according to Soderstrom and Sun (2007) and Daske et al. (2008), the adoption of IFRS is influenced by the country's legal system. According to Daske et al. (2008), the expected result would be a higher quality of the accounting information for common law countries.

Besides, some studies report that common law countries have greater information demands, resulting in a higher quality of accounting information (La Porta et al., 1998, Ball et al., 2000). More specifically, the legal system can influence the value-relevance of fair value estimates, as information is considered more relevant in countries with high-quality legal systems (Mechelli & Cimini, 2019). In addition, Liao et al. (2020) state that the legal system and enforcement affect the value relevance of fair value measurements. Therefore, it is possible to develop the second hypothesis:

H_2: The accounting information following IAS 41 of companies located in common law countries is more relevant to the capital market.

In this context, the role of market analysts must be considered, who can increase the value-relevance of accounting information (Yu, 2013, Khatri, 2023). According to Daske et al. (2013), the number of analysts

[1] Silva and Nardi (2023) only investigated Brazilian companies, while our study analyzed 57 countries, in addition to considering the legal system and monitoring by analysts.

following a firm can capture the changes in the external reporting environment. Hence, the third hypothesis can be presented:

H_3: The accounting information in accordance with IAS 41 of companies located in common law countries is more relevant to the capital market, especially when monitored by market analysts.

Finally, the fourth hypothesis is based on Scott (2012). According to this author, the accounting policies the company adopts will not affect the market price of its shares, as the policies do not influence the company's cash flow. In this case, the investor would be indifferent as to whether biological assets analyzed are measured at historical cost or fair value.

H_4: The use of cost or fair value to measure biological assets is an accounting practice that does not change future cash flows and is therefore irrelevant to investors.

5 MATERIALS AND METHODS

The data were obtained from Thomson Reuters Eikon for the years 2014 and 2015. From a universe of 2,495 companies potentially holding biological assets, a set of 377 companies was selected, based on a prior review of information available from Thomson Reuters Eikon. The sample covers 58 countries (see Table 6 in Appendix A).

In this set, the presence or absence of biological assets was analysed by means of an analysis of the notes to the financial statements. Therefore, the companies were selected by means of a non-random sampling method, since the selection was determined by the industries. In the explanatory notes, the following information was sought: the biological assets; the variation at fair value - unrealised gains and losses related to the change in the fair value of the firm's biological assets; the method of measurement of biological assets; and the types of biological assets.

Next, the following data were collected from Thomson Reuters Eikon: total assets; book value of equity; net income; share price; shares outstanding; market value of equity.

Before working with the data, the accounting values were converted to US dollars (USD) in order to complete the comparative analyses.

Countless difficulties arose in collecting the data from the accompanying notes, such as lack of standardisation in the disclosure of biological assets, even if the accounting statement followed the IFRS. Some account classifications have not been clearly presented in the balance sheets, and the measurement method of biological assets has not been identified in some cases.

After selecting the data, the accounting information relevance models were defined based on Easton (1999), which has already supported many studies in the value-relevance literature (Barth et al., 2001). This method corresponds to tests of association between share price and accounting values. Its foundation is Ohlson's model, which suggests a theory in which the firm's market value is a function of accounting variables, such as earnings and net book value (Ohlson, 1995).

Moreover, relevance is one of the qualitative characteristics of the financial information present in the conceptual framework of IASB, being defined as follows: relevant financial information is capable of making a difference in the decisions made by users. According to Dechow et al. (2010), there is no consensus on the most adequate metrics for measuring the quality of accounting information, but the determinants of information quality are given by the legal and political environment and company characteristics, justifying the presence of other variables in the models below.

The first model presents the decomposition of the net income and book value of equity to assess the value-relevance of the biological assets and the variation at fair value:

$$Price_{it} = \alpha_{0t} + \beta_{1it}(NET\ INCOME - VFV) + \beta_{2it} VFV + \beta_{3it}(BVE - BA) + \beta_{4it} BA + \beta_{5it} Measuring + \beta_{6it} Legal\ System + \beta_{7it} Analysts + \sum_{j}^{j-1} \varphi_{tj} Industry + \varepsilon_{it} \quad (1)$$

Where Price is the share price of company *i* at the end of fiscal year *t* (Huffman, 2018); NET INCOME – VFV is the net income without the effect of the biological assets' variation at fair value at the end of the fiscal year *t*; and VFV is the biological assets' variation at fair value at fiscal year-end *t*, which contains unrealised gains and losses related to the change in the fair value of biological assets (Barth, 1994)[2]. BVE – BA is the book value of equity minus the investment in biological assets at the end of the fiscal year *t* (Gonçalves et al., 2017); BA corresponds to the investment in biological assets at fiscal year-end *t* (Gonçalves et al., 2017); all of them were divided by the amount of shares outstanding at *t* to reduce scale problems. Measuring is a dummy equal to 1 when the company uses the fair value to measure the biological assets and 0 if not; Legal system is a dummy equal to 1 when the company belongs to a country of common law origins (La Porta et al., 1998, Ball et al., 2000); Analysts corresponds to the mean number of analysts who monitored the company in 2014 and 2015, according to Thomson Reuters Eikon (Liao et al., 2020, Khatri, 2023); and Industry is a variable to control for specific effects (Souza et al., 2023). The coefficients β_2 and β_4 are expected to be positive and statistically significant, revealing signs of relevance of the financial information in the capital market context.

The second model is identical to the first model, except for the interactive variable System, which is added to assess the additional information content offered by the countries' institutional aspects.

$$Price_{it} = \alpha_{0t} + \beta_{1it}(NET\ INCOME - VFV) + \beta_{2it}((NET\ INCOME - VFV) \times System) + \beta_{3it} VFV + \beta_{4it}(VFV \times System) + \beta_{5it}(BVE - BA) + \beta_{6it}((BVE - BA) \times System) + \beta_{7it} BA + \beta_{8it}(BA \times System) + \beta_{9it} Measuring + \beta_{10it} Legal\ Systems + \beta_{11it} Analysts + \sum_{j}^{j-1} \varphi_{tj} Industry + \varepsilon_{it} \quad (2)$$

The variables VFV × System and BA × System reveal the information content for the companies from common law countries. Hence, the coefficients β_4 and β_8 are expected to be positive and statistically significant, in view of evidence that the information content in common law countries is superior to that in civil law countries. All accounting variables were divided by the amount of shares outstanding at *t* to reduce scale problems.

The third and final model follows the same line as the second, adding the variable Analysts in the interaction term. According to Daske et al. (2013), the number of analysts following a firm can capture the changes in the external reporting environment.

[2] Barth (1994) used the fair value securities gains and losses, while our study restricted it to biological assets. Therefore, our study used an approach adapted from Barth (1994).

$$Price_{it} = \alpha_{0t} + \beta_{1it}(NET\ INCOME - VFV) + \beta_{2it}((NET\ INCOME - VFV) \times System \times Analysts) + \beta_{3it} VFV + \beta_{4it}(VFV \times System \times Analysts) + \beta_{5it}(BVE - BA) + \beta_{6it}((BVE - BA) \times System \times Analysts) + \beta_{7it} BA + \beta_{8it}(BA \times System \times Analysts)) + \beta_{9it} Measuring + \beta_{10it} Legal\ Systems + \beta_{11it} Analysts + \sum_{j}^{j-1} \varphi_{ij} Industry + \varepsilon_{it} \quad (3)$$

Thus, the coefficients β_4 and β_8 are expected to be statistically positive and significant, demonstrating that the accounting information following IAS 41 is more relevant in common law environments with analysts' monitoring, which signals an informational demand by the capital market. All accounting variables were divided by the number of shares outstanding at *t* to reduce scale problems.

Control variables are necessary to reduce the problem of omitted variables, since pricing mechanisms and the informational environment, including analysts' coverage and disclosure, differ between countries. Nevertheless, it is difficult to construct a regression model that contains all explanatory variables, and the panel data method is one way to control the impact of the variables that were not observed.

6 RESULTS

6.1 The Relevance of Biological Assets

The panel data method needs to respect some premises to generate consistent estimators, which required an analysis of the models. Initially, the multicollinearity problem was identified, but it was fixed after removing some variables.

Next, to treat the problems of heteroscedasticity and self-correlation, the Huber-White or Sandwich adjustment (Huber, 1967, White, 1980) was used to estimate the covariance matrix of the parameter estimates. According to Cameron and Trivedi (2010), this adjustment is suitable for panel data. The initial results are displayed below.

Table 2
"Test results of model 1"

	Base model (fixed effects)	**First model (fixed effects)**
Intercept	7 / (12.03)***	7 / (7.5)***
NET INCOME	1516 / (1.75)*	
NET INCOME – VFV		1138 / (1,44)
VFV		1778 / (1.03)
BVE	816 / (4.74)***	
BVE – BA		426 / (1.71)*
BA		29 / (1.25)
Number of observations	401	251
F	12.97***	1.27
R^2	0.21	0.17
Hausman test	14.95***	97.79***
Farrar-Glauber multicollinearity tests	312***	337***
Wald test	1.3e+40***	4.0e+38***

Source: Prepared by the authors

Obs.: Price is the price of company i's share at the end of fiscal year t; NET INCOME corresponds to the result of year t; BVE is the book value of equity at the end of t; both were divided by outstanding shares at t to reduce scale problems; NET INCOME – VFV is the result without the effect of the variation at fair value of the biological assets; VFV is the variation at fair value of the biological assets. BVE – BA is the book value of equity without investing in biological assets; BA corresponds to investments in biological assets. All variables except dummies went through the winsorisation process, for the entire period of analysis. We winsorised at 0.05 level. The Wald test was used to assess the heteroscedasticity. The Farrar-Glauber multicollinearity test was used to assess the multicollinearity. The variables Legal System, Analysts, Industry Brewers, Industry Distillers & Vintners, Industry Forest Products, Industry Packaged Foods & Meats, Industry Paper Products were dropped. Coefficients ***, **, and * are statistically significant at the level of 0.01, 0.05, and 0.10, respectively.

In the base model, without the biological asset variables, there is evidence of low relevance of the accounting information. However, it should be noted that the quality of the financial information investigated by the model is restricted to the behaviour of investors, given the share prices traded in the capital market. Some countries have an underdeveloped capital market, which requires additional testing to assess the quality of information more specifically.

In the first model, there is no evidence that the change in the fair value of biological assets is relevant for investors, and the same is true for the biological assets. The result for the variation at fair value includes all the biological assets, those with an active market and those without an active market.

The most representative case is a bearer plant, known as palm oil plantation, which is measured by its fair value. The fair value of these biological assets is measured by the discounted cash flow method; some biological assets do not have an active market, which can reduce the reliability of these accounting numbers due to the diversity of assumptions (Fisher et al., 2010, Argilés-Bosch et al., 2011, Rech & Pereira, 2012).

The results are consistent with the efforts of analysts and investors to amend IAS 41, specifically the measurement of bearer plants. The consequence was the change in the measurement base of bearer plants, which began to be measured at historical cost, equating the measurement base of bearer plants with property, plant, and equipment, therefore going beyond the scope of IAS 41 and entering IAS 16.

The justification is that the mature bearer plants no longer present biological transformation but continue to provide agricultural production during their productive lives. As a result, the future economic benefits are only possible through the sale of the agricultural production that the bearer plants generate. The changes are required as from January 2016, and therefore do not take into consideration in this research.

In addition, it is worth remembering that management has incentives to choose valuation methods that increase the current net income (Watts & Zimmerman 1986). In the event that investors mistrust the quality of estimates of the fair value of biological assets, this information may become irrelevant to them, consistent with the result for the change in the fair value of biological assets.

In the same sense, the biological assets variable (BA) is not statistically significant. This result reveals that investments in biological assets are not significant for information users, such as investors and analysts. These results are in line with part of the literature (Booth & Walker, 2003, Dvorakova, 2006, Oliveira & Nakao, 2021), and other studies indicate the value-relevance of biological assets (Martins et al., 2014, Gonçalves et al., 2017, Huffman, 2018). In this sense, considering that there are conflicting results in the literature and those investors and analysts may demand companies' investment in biological assets for

balance sheet analysis purposes, our results must be analyzed with caution, mainly because our results restricted to a group of companies for the years 2014 and 2015.

Furthermore, it is worth mentioning that biological assets may contain acquisitions of third parties, new investments, or a physical change of the biological asset, for example, the growth of an animal or plant. However, the results for VFV and BA allow us to reject the proposal that the accounting information following IAS 41 is relevant to the capital market, at least for our sample, and for the years 2014 and 2015.

6.2 The Relevance of Biological Assets Considering the Legal System

It is known that one aspect that influences the informational demand in the capital market is the legal system (La Porta et al., 1998, Ball et al., 2000). Some studies report that common law countries have greater information demands, resulting in a higher quality of accounting information. To test this hypothesis, the base model was adapted to observe the effect of the legal environment on the relevance of accounting information. The table below presents the results.

Table 3
"Test results of model 2"

	Base model (fixed effects)	**Second model (fixed effects)**
Intercept	7 / (9.40)***	7 / (9.84)***
NET INCOME	2274 / (2.62)***	
NET INCOME × System	-3095 / (-1.39)	
NET INCOME – VFV		1949 / (1.79)*
(NET INCOME – VFV) × System		-2392 / (-1.37)
VFV		-2274 / (-1.81)*
VFV × System		3894 / (1.34)
BVE	851 / (4.65)***	
BVE × System	-274 / (-0.39)	
BVE – AB		278 / (3.66)***
(BVE – BA) × System		160 / (0.24)
BA		55 / (1.97)**
BA × System		-13 / (-0.27)
Number of observations	401	252
F	6.62***	2.87***
R^2	0.17	0.14
Hausman test	590.89	-5.94
Farrar-Glauber multicollinearity tests	838***	1616***
Wald test	1.9e+43***	3.9e+40***

Source: Prepared by the authors

Obs.: System is a dummy equal to 1 when the company belongs to a country of common law origin; the variables Measuring, System, Analysts, Industry Distillers & Vintners, Industry Forest Products, Industry Packaged Foods & Meats, Industry Paper Products and Industry Brewers were dropped. Coefficients ***, **, and * are statistically significant at the level of 0.01, 0.05, and 0.10, respectively

The base model does not reveal information quality for companies belonging to common law countries, as the coefficients of the variables NET INCOME × System and BE × System do not have statistical significance.

The second model does not show relevant information for common law countries, whether for fair value variation (VFV × System) or biological assets (BA × System). In fact, by restricting the analysis of the book value of equity without biological assets for this group of countries, the informational relevance is lost ((BVE – BA) × System), while the analysis covering all countries grants relevance to the book value of equity (BVE – BA).

In addition, most of the countries studied have civil law origin, which may influence the results in some way, with the participation of small, medium, and large companies. Therefore, this result is favorable evidence for rejecting research hypothesis 2, allowing us to conclude that the financial information following IAS 41 of companies located in common law countries is no longer relevant.

In additional tests, the base model from Table 4 was applied for random effects, as the Hausman test was found to be inconclusive for the specification of the model. Based on the results, the effect of the Measuring variable on the share price behavior can be assessed.

Table 4
"Test results of base model in Table 3"

	Base model (random effects)
Intercept	-6 / (-3.51)***
NET INCOME	3581 / (2.14)***
NET INCOME × System	6399 / (0.86)
BVE	1466 / (3.25)***
BVE × System	-131 / (-0.13)
Measuring	1 / (0.64)
Legal System	11 / (4.16)***
Analysts	-0,1 / (-0,29)
Industry Brewers	9 / (1.54)
Industry Distillers & Vintners	15 / (2.46)**
Industry Forest Products	-1 / (-0.29)
Industry Packaged Foods & Meats	8 / (2.21)**
Industry Paper Products	10 / (1.64)
Number of observations	401
F	61.08***
R^2	0.33

Source: Prepared by the authors

Obs.: Analysts corresponds to the mean number of analysts that monitor the company in 2014 and 2015; measuring is a dummy equal to 1 when the company measures biological assets at fair value and 0 if not; industry is a variable to control specific effects. Coefficients ***, **, and * are statistically significant at the level of 0.01, 0.05, and 0.10, respectively.

The base model for random effects presents results that are similar to the fixed-effects model and also reveals that the Measuring variable is not relevant for explaining the share prices. This means that the investor would be indifferent as to the choice between analysing biological assets measured at historical cost or fair value, which allows research hypothesis 4 to be accepted: the use of cost or fair value to measure biological assets is an accounting practice that does not change future cash flows and is therefore irrelevant to investors.

To test the third research hypothesis, the accounting data for companies from common law countries monitored by market analysts were restricted. The results can be seen in Table 5 below.

Table 5
"Test results of model 3"

	Base model (fixed effects)	Third model (fixed effects)
Intercept	7/ (13.34)***	6 / (4.36)***
NET INCOME	1674 / (1.75)*	
NET INCOME × System × Analysts	-241 / (-0.83)	
NET INCOME – VFV		2236 / (2.10)**
(NET INCOME – VFV) × System × Analysts		-332 / (-0.84)
VFV		2788 / (1.50)
VFV × System × Analysts		-1126 / (-2.05)**
BVE	869 / (4.75)***	
BVE × System × Analysts	-184 / (-2.80)***	
BVE – AB		865 / (4.06)***
(BVE – BA)x System × Analysts		-88 / (-0.66)
BA		6 / (0.31)
BA × System × Analysts		-8 / (-0.74)
Number of observations	401	251
F	7.01	2.99***
R^2	0.08	0.21
Hausman test	90.42***	26.30***
Farrar-Glauber multicollinearity tests	766***	1152***
Wald test	5.7e+40***	7.8e+37***

Source: Prepared by the authors

Obs.: The variables Measuring, Legal System, Analysts, Industry Distillers & Vintners, Industry Forest Products, Industry Packaged Foods & Meats, Industry Paper Products, and Industry Brewers were dropped. Coefficients ***, **, and * are statistically significant at the level of 0.01, 0.05, and 0.10, respectively

The findings for the base model of Table 5 show that companies from common law countries and accompanied by market analysts present more relevant financial information, represented by the variable BVE × System × Analysts. The negative sign, however, shows that the book value of equity variations causes a negative variation in the share price. The drop in the sample companies' BVE by 10% in 2015–2014 can explain this result.

The third model does not reveal informational content for the investments in biological assets (BA × System × Analysts), while the variation at fair value (VFV × System × Analysts) is relevant for the capital market, but with a negative sign. Therefore, these results do not permit conclusions to be drawn on the relevance of the accounting information of companies from common law countries monitored by analysts. In other words, these results permit the rejection of the hypothesis that the accounting information following IAS 41 of companies in common law countries is more relevant to the capital market, especially when monitored by market analysts.

6.3 Discussion

The common law countries have a more reliable legal environment from the investors' viewpoint, as they present high protection for minority shareholders and creditors as well as a high level of enforcement. Consequently, the expected result would be a higher quality of the accounting information for common law countries (Daske et al., 2008).

On average, the companies' biological assets in the sample correspond to 13.7% of the total assets, while the fair value variation represents 14.7% of the net income. The industry with the highest investment in biological assets is Paper Products, which is the only industry that presents a negative fair value variation: USD –4.395 billion. The Agricultural Products industry contains the largest number of companies: 201.

Moreover, most companies use fair value as a measurement basis for biological assets, and the disclosure still leaves a lot to be desired. Some companies did not adequately disclose their accounting policies and investments in biological assets, which may generate some difficulty in the comparative analysis of companies in the same industry.

The results of the econometric models show that the measurement method is irrelevant to investors, consistent with doubts about the reliability of fair value for some biological assets, which permits research hypothesis 1 to be rejected: the accounting information following IAS 41 is relevant to the capital market.

In the event of doubtful information, the use of cost or fair value as the basis for measuring biological assets is an accounting practice that does not change future cash flows. In line with that, one of the models analysed (Table 4) shows that the investors are indifferent as to the choice between analysing biological assets measured at historical cost or fair value. This permits the acceptance of research hypothesis 4: the use of cost or fair value to measure biological assets is an accounting practice that does not change future cash flows.

The variation in the fair value of biological assets is also found to be irrelevant in the context of the capital market. Measurement at fair value through non-fully observable methods can also generate information of low relevance, which is one of the reasons that led to the change for the bearer plants. Added to this are the incentives that management has to increase companies' current net income through earnings management practices.

The literature is inconclusive on the utility of information on biological assets (Picture 1), and we present evidence that this information is not relevant for the capital market. The differential of this study is an analysis of the notes to the financial statements of 377 companies from 58 countries. In addition, the analysis of the biological assets restricted by legal system and analyst monitoring did not reveal any information relevance for biological assets and their fair value variation, contrary to expectations.

Furthermore, although the adoption of IAS 41 in several countries implies uniformity of the financial reports, as they follow the same accounting standard, the quality of the accounting information on biological assets is compromised. The behavior in the disclosure of financial statements requires a radical change in the performance of economic and political agents that may influence the enforcement level of the IFRS implementation.

The simple change from local GAAP to IFRS does not guarantee the quality of the accounting information, as already pointed out in Soderstrom and Sum (2007). In our study, common law countries do not present superior results, despite having more efficient and protective institutional aspects, which permits the rejection of research hypothesis 2: the accounting information following IAS 41 of companies located in common law countries is more relevant to the capital market.

Most of the companies studied belong to civil law countries, though, which can explain this result. This means rejecting hypothesis 3: the accounting information in accordance with IAS 41 of companies located in common law countries is more relevant to the capital market, especially when monitored by market analysts.

In this context, there is scope to discuss aspects of recognition, measurement, and disclosure of IAS 41, in view of the mixed evidence on the value-relevance of biological assets (Booth & Walker, 2003, Dvorakova, 2006, Martins et al., 2014, Gonçalves et al., 2017, Huffman, 2018, Oliveira & Nakao, 2021), in addition the amendment in the measurement basis of bearer plants. Furthermore, part of the literature shows that biological asset valuation models still have problems (Machado et al., 2014, Morozova et al., 2019, Biljon & Wingard, 2020, Silva et al., 2022), which reinforces the necessity to expand the discussion on biological assets.

The consequences of underproduction of information weaken the efficient market hypothesis, leading to higher funding and resource allocation costs. This failure can generate adverse selection and moral hazard problems. The existence of these deficiencies justifies the regulation activity with a view to maximising the wellbeing of society and the proper functioning of the market.

We hope that this result will be useful for different accounting users, including the regulator IASB, which is constantly reviewing the international standards. For example, in the project “Better Communication in Financial Reporting”, different initiatives are undertaken to increase the quality of the accounting information, that is, to make the information relevant for investors.

From the analysts' point of view, they have the role of providing information on the economic and financial performance of companies, helping to reduce information asymmetry between agents. In this sense, the question arises: are investors and analysts able to use information on biological assets appropriately to assess risk and prepare their estimates?

We also contribute to the academic literature that examines the value-relevance of accounting information following IAS 41, as we present empirical evidence on the relevance of the fair value of biological assets, which can reinforce the debate on the measurement bases used in accounting.

Although the change of the standard is recent, prohibiting fair value measuring for bearer plants, some aspects still need further discussion, such as the fair value measuring of produce growing on bearer plants, which can take considerable time. Our research reveals that 88% of the companies use the fair value. For some fair value valuations, a technique may be necessary that demands considerable time and study from the company’s employees, mainly in case of valuation techniques with unobservable inputs. In this case, the company is spending money to produce information that the market considers irrelevant.

7 CONCLUSION

IAS 41 provides the accounting treatment for biological assets. This standard is part of the IASB standards, which some scholars acknowledge as a high-quality accounting system, contributing to the generation of financial statements with greater informational content. However, IAS 41 recently received some criticism regarding the fair value measurement method of some biological assets in addition to the occurrence of low quality of disclosure. In this sense, some studies have begun to investigate the quality of information disclosed in accordance with IAS 41, but most explore the topic by country without considering institutional aspects.

Therefore, this article sought to investigate whether the accounting information on biological assets offers earnings quality to investors from 58 countries, demonstrated by the relevance of the biological assets and their fair value variation. It should be emphasised that the sample originally consisted of companies that have biological assets. The methods include prior data analysis and testing for panel data models.

A preliminary analysis of the financial statements revealed that the most used measuring method is the fair value and that the disclosure is very weak, which can make it difficult to compare investments in biological assets.

The findings for the models reveal that, although the common law countries present a more reliable legal environment for investors, the analysis of the biological assets’ information quality revealed a lack of relevance for the variation in the fair value of biological assets and investment in biological assets, even when restricting the analysis to common law countries monitored by market analysts. Nevertheless, most companies in the sample belong to civil law countries, which can help to understand this empirical evidence that does not support Daske et al. (2008).

Where the measuring method is concerned, the investors are found to be indifferent as to the choice between analysing biological assets measured at historical cost or fair value, in line with earlier results.

These results are consistent with the existence of asymmetric information among investors, who seek to evaluate the performance of entities engaged in agricultural activities. In some countries, the development of such activities is crucial to the growth of the economy, which makes the issue highly relevant. In this sense, there is still room to discuss aspects of recognition, measurement, and disclosure of IAS 41, since the underproduction of information weakens the efficient market hypothesis, generating higher funding costs. One aspect that could be further discussed by regulators and stakeholders is the disclosure of non-financial[3] information that could meet the demand of some market analysts (Nakao, 2017). In this sense, accounting information could be more useful for forecasting purposes, allowing a better assessment of risks.

A suggestion for future research is the separation of the fair value measurement methods by level of hierarchy: level 1, level 2, and level 3, according to IFRS 13. This control would be fundamental to verify the credibility that the market attributes to the model used to value biological assets. In addition, amendments in bearer plants were required starting in January 2016, while the data from this survey cover 2014 and 2015.

For future research, assessing the effects of the change in the IAS 41 standard is also suggested, which implies studying for a period longer than two years. In addition, it is suggested that the sample size should be expanded with other databases and that some other implications of accounting quality which can be tested in an international setting, like analyst forecast revision and analyst forecast errors, should be considered.

The main limitations of this research include the analysis of the relevance of the financial statements from the investor's perspective, but the users of financial statements can consider other aspects related to the companies not considered in this research. Finally, there was great difficulty in collecting company data, in function of the language, publication form, clarity of the notes to the financial statements.

REFERENCES:

Argilés-Bosch, J. M, Garcia-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*, 14(2), 87–113. https://doi.org/10.1016/S1138-4891(11)70029-2

Argilés-Bosch, J. M., Aliberch, A. S., & Garcia-Blandon, 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*, 15(1), 109–142. https://doi.org/10.1016/S1138-4891(12)70040-7

Armstrong, C. S., Barth, M. E., Jagolinzer, A. D., & Riedl, E. J. (2010). Market reaction to the adoption of IFRS in Europe. *The Accounting Review*, 85(1), 31–61. DOI: 10.2308/accr.2010.85.1.31

Ball, R. (2006). International Financial Reporting Standards (IFRS): pros and cons for investors. *Accounting and Business Research*, *International Accounting Policy Forum*, 5–27. https://doi.org/10.1080/00014788.2006.9730040

Ball, R., Kothari, S. P., & Robin, A. (2000). The effect of institutional factors on properties of accounting earnings. *Journal of Accounting and Economics*, 29(1), 1–51. https://doi.org/10.1016/S0165-4101(00)00012-4

Ball, R., Robin, A., & Wu, J. S. (2003). Incentives versus standards: properties of accounting income in four East Asian countries. *Journal of Accounting and Economics*, 36, 235–270. https://doi.org/10.1016/j.jacceco.2003.10.003

Barth, M. E. (1994). Fair Value Accounting: Evidence from Investment Securities and the Market Valuation of Banks. *The Accounting Review*, 69(1), 1-25. http://www.jstor.org/stable/248258

[3] Examples: disclosures about productivity, including age profiles, estimates of the physical quantities of bearer plants and output of agricultural produce (IFRS 2015, Nakao, 2017).

Barth, M. E., Landsman, W. R., & Lang, M. H. (2008). International accounting standards and accounting quality. *Journal of Accounting Research*, 46(3), 467–498. DOI: 10.1111/j.1475-769X.2008.00287.x

Biljon, M. & Wingard, C. (2020). An agricultural sector assessment of biological asset valuation challenges with inputs considered from valuers. *International Journal of Financial, Accounting, and Management*, 2, 243-258. 10.35912/ijfam.v2i3.265.

Booth, B., & Walker, R. G. (2003). Valuation of SGARAs in the wine industry: time for sober reflection. *Australian Accounting Review*, 13(3), 52–60. DOI:10.1111/j.1835-2561.2001.tb00171.x

Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics Using Stata*. Texas: Stata Press.

Cavalheiro, R. T., Binotto, E., Martins, L. C. & Gimenes, R. M. T. (2017). Ativos biológicos e produtos agrícolas: um estudo comparativo da produção científica. *Custos e @gronegócio on line*, 13(3), 202-232. http://www.custoseagronegocioonline.com.br/numero3v13/OK%2011%20biologicos.pdf

Cavalheiro, R. T., Gimenes, R. M. T., & Binotto, E. (2019). Are Accounting Choices in Measuring Biological Assets Associated with the Profile of the Accounting professional? *Sociedade, Contabilidade e Gestão*, 14(2), 43-64. https://doi.org/10.21446/scg_ufrj.v0i0.22029

Cavalheiro, R. T., Gimenes, R. M. T., Binotto, E.; & Fietz, C. R. (2019). Fair Value of Biological Assets: An Interdisciplinary Methodological Proposal. *Revista de Administração Contemporânea*, 23(4), 543-563. https://doi.org/10.1590/1982-7849rac2019180254

Christensen, H. B., Hail, L., & Leuz, C. (2013). Mandatory IFRS reporting and changes in enforcement. *Journal of Accounting and Economics*, 56(3), 147–177. https://doi.org/10.1016/j.jacceco.2013.10.007

Christensen, H. B., Lee, E., Walker, M., & Zeng, C. (2015). Incentives or standards: What determines accounting quality changes around IFRS adoption? *European Accounting Review*, 24(1), 31–61. https://doi.org/10.1080/09638180.2015.1009144

Daly, A., & Skaife, H. A. (2016). Accounting for biological assets and the cost of debt. *Journal of International Accounting Research*, 15(2), 31–47. https://doi.org/10.2308/jiar-51335

Damian, M. I., Manoiua, S. M., Bonaci, C. G., & Strouhal, J. (2014). Bearer plants: stakeholders' view on the appropriate measurement model. *Accounting and Management Information Systems*, *13*(4), 719–738.

Daske, H., Hail, L., Leuz, C., & Verdi, R. (2008). Mandatory IFRS reporting around the world: early evidence on the economic consequences. *Journal of Accounting Research*, 46(5), 1085–1142. https://doi.org/10.1111/j.1475-679X.2008.00306.x

Daske, H., Hail, L., Leuz, C., & Verdi, R. (2013). Adopting a label: heterogeneity in the economic consequences around IAS/IFRS adoptions. *Journal of Accounting Research*, 51(3), 495–547. https://doi.org/10.1111/1475-679X.12005

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, 344–401. https://doi.org/10.1016/j.jacceco.2010.09.001

Dvorakova, 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.

Easton, P. (1999). Security returns and the value relevance of accounting data. *Accounting Horizons*, 13(4), 399–412. https://doi.org/10.2308/acch.1999.13.4.399

Figueira, L. M., & Ribeiro, M. S. (2016). Analysis of the disclosure on the measurement of biological assets: before and after CPC 29. *Revista Contemporânea de Contabilidade*, 12(26), 73-98. https://doi.org/10.5007/2175-8069.2015v12n26p73

Fisher, R., Mortensen, T., & Webber, D. (2010). Fair value accounting in the agricultural sector: an analysis of financial statement preparers' perceptions before and after the introduction of IAS 41 agriculture. In *Accounting & Finance Association of Australia and New Zealand – AFAANZ*. Christchurch, New Zealand. Anais. http://www.afaanz.org/openconf/2010/modules/request.php?module=oc_program&action=view.php&id=57.

Garcia, E. L. M., Sanches, S. L. R., & Igarashi, D. C. C. (2016). *Evidenciação dos ativos biológicos nas melhores e maiores empresas do setor de celulose e papel: uma comparação entre empresas abertas e fechadas*. ConTexto-Contabilidade em Texto, 16(32), 20-36. https://seer.ufrgs.br/index.php/ConTexto/article/view/54010

Goh, C., Lim, C. Y., Ng, J., Pan, G., & Yong, K. O. (2021). Trust in fair value accounting: evidence from the field. *Journal of International Accounting Research*, 20(3), 21–42. https://doi.org/10.2308/JIAR-2021-034

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

He, Y. L., Wright, S., & Evans, E. (2018). Is fair value information relevant to investment decision making: Evidence from the Australian agricultural sector? *Australian Journal of Management*, 43(4), 1–20. DOI: 10.1177/0312896218765236

He, L., Wright, S., & Evans, E. (2021). The impact of managerial discretion on fair value information in the Australian agricultural sector. *Accounting & Finance*, 61, 1897-1930. https://doi.org/10.1111/acfi.12647

Herbohn, K. (2006). Accounting for SGARAs: a stocktake of accounting practice before compliance with AASB 141 Agriculture. *Australian Accounting Review*, 16(2), 62–76. DOI:10.1111/j.1835-2561.2006.tb00361.x

Herbohn, K., & Herbohn, J. (2006). International Accounting Standard (IAS) 41: What are the implications for reporting forest assets? *Small-Scale Forestry*, 5, 175–189. https://doi.org/10.1007/s11842-006-0009-1. DOI:10.1007/s11842-006-0009-1

Barth, M. E., Holthausen, R. W., & Watts, R. L. (2001). The relevance of value-relevance literature for financial accounting standard setting. *Journal of Accounting and Economics*, 31(1–3), 3–75. https://doi.org/10.1016/S0165-4101(01)00019-2

Huber, P. J. (1967). The behavior of maximum likelihood estimates under nonstandard conditions. In *Berkeley Symposium on Mathematical Statistics and Probability*, *15*, Berkeley, CA, Anais … Berkeley: University of California, 1, 221–233.

Huffman, A. (2018). Asset use and the relevance of fair value measurement: evidence from IAS 41. *Review of Accounting Studies*, 23(4), 1274–1314. DOI: 10.1007/s11142-018-9456-0

International Accounting Standards Board – IASB. (2022). *Report of the Emerging Economies Group Meeting*. London, United Kingdom, 16–17 May 2022. https://www.ifrs.org/content/dam/ifrs/groups/eeg/eeg-report-may-2022.pdf

International Financial Reporting Standards (IFRS). (2015). Exposure Draft ED/2013/8. *Agriculture: Bearer plants proposed amendments to IAS 16 and IAS 41*. https://www.ifrs.org/content/dam/ifrs/project/agriculture-bearer-plants/ed-agriculture-bear er-plants-june-2013.pdf.

Jana, H., & Marta, S. (2014). The fair value model for the measurement of biological assets and agricultural produce in the Czech Republic. *Procedia Economics and Finance*, 12, 213–220. https://doi.org/10.1016/S2212-5671(14)00338-4

Jensen, M. C. & Meckling, W. H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Khatri, I. (2023). The role of analyst coverage and value-relevance of energy efficiency. *Review of Accounting and Finance*, 22(2), 249-265. https://doi.org/10.1108/RAF-08-2022-0211

La Porta, R., Lopez-De-Silanes, F. & Shleifer, A. (1999). Corporate ownership around the world. *The Journal of Finance*, 54(2), 471–517. https://doi.org/10.1111/0022-1082.00115

La Porta, R., Lopez-De-Silanes, F., Shleifer, A., & Vishny, R. (1997). Legal determinants of external finance. *The Journal of Finance*, 52(3), 1131–1150. https://doi.org/10.2307/2329518

La Porta, R., Lopez-De-Silanes, F., Shleifer, A., & Vishny, R. (1998). Law and finance. *Journal of Political Economy*, 106(6), 1113–1155. https://doi.org/10.1086/250042

Lewis, A. E., & Jones, W. D. (1980). Current cost accounting and farming businesses. *Journal of Agricultural Economics*, 31(1), 45–53. https://doi.org/10.1111/j.1477-9552.1980.tb02123.x

Liao, L., Yao, D., Kang, H. & Morris, R. D. (2020). The impact of legal efficacy on value relevance of the three-level fair value measurement hierarchy. *Pacific-Basin Finance Journal*, 59, 201259. https://doi.org/10.1016/j.pacfin.2019.101259

Marsh, T., & Fischer, M. (2013). Accounting for agricultural products: US Versus IFRS GAAP. *Journal of Business & Economics Research*, 11(2), 79–87. http://scholarworks.sfasu.edu/accounting_facultypubs/4.

Martins, E., Martins, V. A., & Martins, E. A. (2007). Normatização Contábil: ensaio sobre sua evolução e o papel do CPC. *Revista de Informação Contábil*, 1(1), 7–30. https://doi.org/10.34629/ufpe-iscal/1982-3967.2007.v1.7-30

Machado, M. J. C., Martins, E. A., & Carvalho, L. N. (2014). Reliability in fair value of assets without an active market. *Advances in Scientific and Applied Accounting*, 7(3), 319-338. https://doi.org/10.14392/asaa.2014070301

Martins, V. G., Machado, M. A. V., & Callado, A. L. C. (2014). Relevance and faithful representation in the measurement of biological assets at fair value by companies listed on the BM&FBovespa. *Revista Contemporânea de Contabilidade*, 11(22), 163-188. https://doi.org/10.5007/2175-8069.2014v11n22p163

Mechelli A., & Cimini, R. (2019). Corporate governance, legal systems and value relevance of fair value estimates. Empirical evidence from the EU banking sector. *Spanish Journal of Finance and Accounting*, 48(2), 203-223, DOI: 10.1080/02102412.2018.1471309

Morozova, T. V., Akhmadeev, R. G., Bykanova, O. A., & Philippova, N. V. (2019). Harmonizing the Valuation Standards of the EEU Agricultural Companies. International *Journal of Recent Technology and Engineering*, 8(2), 255-277. https://www.ijrte.org/wp-content/uploads/papers/v8i1/A1942058119.pdf

Moutinho, R. A.; & Silva, R. L. M. (2023). Um Estudo Internacional dos Direcionadores do Método De Mensuração de Ativos Biológicos. *Sociedade, Contabilidade e Gestão*, 18(2). https://doi.org/10.21446/scg_ufrj.v18i2.52529

Nakao, S. H. (2017). *Contabilidade Financeira no Agronegócio*. São Paulo: Atlas.

Ohlson, J. (1995). Earnings, book values and dividends in security valuation. *Contemporary Accounting Research*, 11, 661–687. https://doi.org/10.1111/j.1911-3846.1995.tb00461.x

Oliveira, D. L. & Nakao, S. H. (2021). O que temos de pesquisa sobre 'mensuração de ativos biológicos' em 20 anos da IAS 41 –Agriculture? *Custos e @gronegócio on line*, 17(4), 256-298. http://www.custoseagronegocioonline.com.br/numero4v17/OK%2014%20ativos.pdf

Oliveira, D. L. & Nakao, S. H. (2023). Uniformity and consistency of choices in the recognition and measurement of biological assets. *Revista Contemporânea de Contabilidade*, 20(54), 01-21. https://doi.org/10.5007/2175-8069.2023.e83268

Oliveira, D. L., Scarmocin, L. F. & Silva, R. L. M. (2020). Contabilidade de Ativos Biológicos no Brasil: análise do campo de conhecimento uma década após a edição do CPC 29. *Revista de Contabilidade do Mestrado em Ciências Contábeis da UERJ*, 25(3), 133-154. https://www.e-publicacoes.uerj.br/rcmccuerj/article/view/51465/pdf

Rabassi, R. S.; Batalha, M. O.; & Albuquerque, A. A. (2020). Valuation of biological assets at fair value: impacts on decision-making in agro-industrial companies. *Custos e @gronegócio on line*, 16(1), 2-25. http://www.custoseagronegocioonline.com.br/numero1v16/OK%201%20biologicos%20en glish.pdf

Rech, I. J., & Pereira, I. V. (2012). Valor justo: análise dos métodos de mensuração aplicáveis aos ativos biológicos de natureza fixa. *Custos e @gronegócio Online*, 8(2). http://www.custoseagronegocioonline.com.br/numero2v8/valor.pdf

Scott, W. R. (2012). *Financial Accounting Theory* (5th ed.). Toronto, Ontario: Pearson Canada.

Silva, R. L. M., Figueira, L. M., Pereira, L. T. O. A. & Ribeiro, M. S. (2013). CPC 29: Uma análise dos requisitos de divulgação entre empresa de capital aberto e fechado do setor de agronegócios. *Sociedade, Contabilidade e Gestão*, 8(1). https://doi.org/10.21446/scg_ufrj.v8i1.13281

Silva, R. L. M. & Nardi, P. C. C. (2023). IAS 41 and Biological Assets in Brazil: is the information really useful? *Revista Catarinense da Ciência Contábil*, 22, 1-30. DOI:10.16930/2237-7662202333651

Silva, R. L. M., Nardi, P. C. C., Mendes, G. S., & Oliveira, D. de L. (2022). Dissecando a mensuração da cana-de-açúcar a valor justo: buscando melhorias na informação contábil. *Custos e @gronegócio online*, 18(1), 187-211. http://www.custoseagronegocioonline.com.br/numero1v18/OK%209%20cana.pdf

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

Soderstrom, N. S. & Sun, K. J. (2007). IFRS adoption and accounting quality: a review. *European Accounting Review*, 16(4), 675–702. https://doi.org/10.1080/09638180701706732

Souza, M. P. R., Marques, C. & Rech, I. J. (2023). Influence of the method of measurement of biological assets in the quality of earnings. *Revista Contemporânea de Contabilidade*, 20(54), 01-14. https://doi.org/10.5007/2175-8069.2023.e78681

Souza, M P. R., & Shikida, P. R. A. (2021). Impact of Amendments to IAS 16 and IAS 41 on the Economic-Financial Position of Brazilian Sugar-Energy Companies. *Journal of Accounting, Management and Governance,* 24(1),92-108. http://dx.doi.org/10.51341/1984-3925_2021v24n1a6

Watts, R. L., & Zimmerman, J. L. (1986). *Positive Accounting Theory*. Prentice-Hall.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817–838. https://doi.org/10.2307/1912934

Williams, B. R., & Wilmshurst, T. (2009). The achievability of sustainable reporting practices in agriculture. *Corporate Social Responsibility and Environmental Management*, 16, 155–166. https://doi.org/10.1002/csr.190

Yu, K. (2013). Does Recognition versus Disclosure Affect Value Relevance? Evidence from Pension Accounting. *The Accounting Review*, 88(3), 1095–1127. https://doi.org/10.2308/accr-50381

Zeghal, D., Chtourou, S. M., & Fourati, Y. M. (2012). The effect of mandatory adoption of IFRS on earnings quality: evidence from the European Union. *Journal of International Accounting Research*, 11(2), 1–25. https://doi.org/10.2308/jiar-10221

Appendix A

Table 6
"sample firms by country"

Argentina	9	Finland	3	Kazakhstan	1	Poland	1
Australia	13	France	4	Kenya	1	Portugal	3
Belgium	4	Germany	4	Latvia	2	Russia	2
Brazil	10	Ghana	1	Lithuania	2	Saudi Arabia	6
Bulgaria	1	Greece	4	Luxembourg	4	Singapore	9
Canada	9	Guernsey	1	Malaysia	5	South Africa	8
Cayman Islands	1	Hong Kong	1	Mauritius	0	South Korea	1
Chile	27	India	4	Mexico	3	Spain	4
China	57	Indonesia	3	New Zealand	1	Sri Lanka	1
Colombia	3	Ireland	1	Nigeria	8	Sweden	9
Croatia	5	Israel	1	Norway	2	Taiwan	1
Cyprus	1	Italy	1	Pakistan	1	Turkey	5
Denmark	4	Jamaica	1	Peru	1	Ukraine	1
Egypt	2	Jersey	1	Philippines	11	United Kingdom	3
						Zimbabwe	7
							5

Source: Prepared by the authors

Endereço dos Autores:

Vila Monte Alegre, CEP: 14040905
Ribeirão Preto - SP - Brazil