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Measurement and disclosure criteria for biological assets for Chilean and Peruvian companies

Criterios de medición y revelación de activos biológicos para empresas chilenas y peruanas

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Abstract

This article examines how listed companies in Peru and Chile have applied the measurement and disclosure criteria for biological assets under IAS 41. Additionally, it seeks to determine the influence of variables such as country, type of audit firm, nature of the biological asset, investment in biological assets, company size, and profitability on these measurement criteria and disclosure levels. We used a quantitative approach, a descriptive-relational cross-sectional study on the 2021–2022 financial statements, and a content analysis of the annual reports and Chi-Square, one-factor ANOVA, and Pearson correlation tests to test our hypotheses. The findings demonstrate that neither the country, type of audit firm, nor the type of biological asset impacted the measurement model. The disclosure level primarily includes descriptions of biological assets, agricultural activities, and financial risks; it is higher for Chilean companies and those audited by the 'Big Four' audit firms. There was a significant correlation between investment in biological assets and profitability with the level of disclosure, which is higher for companies with substantial investments in biological assets that seek greater transparency with their investors and creditors in their investment decisions.

Keywords: Agricultural activity; Biological assets; Measurement criteria; Financial disclosure; Fair value.

Resumen

Este artículo examina la forma en que las empresas cotizadas de Perú y Chile han aplicado los criterios de medición y revelación de información sobre los activos biológicos con arreglo a la NIC 41. Adicionalmente, se busca determinar la influencia de variables como país, tipo de firma auditora, naturaleza del activo biológico, inversión en activos

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biológicos, tamaño de la empresa y rentabilidad sobre estos criterios de medición y niveles de revelación. Utilizamos un enfoque cuantitativo, un estudio descriptivo-relacional transversal sobre los estados financieros de 2021-2022, y un análisis de contenido de los informes anuales y pruebas de Chi-cuadrado, ANOVA de un factor y correlación de Pearson para probar nuestras hipótesis. Los resultados demuestran que ni el país, ni el tipo de empresa auditora, ni el tipo de activo biológico influyeron en el modelo de medición. El nivel de divulgación incluye principalmente descripciones de activos biológicos, actividades agrícolas y riesgos financieros; es mayor para las empresas chilenas y las auditadas por las firmas de auditoría *Big Four*. Hubo una correlación significativa entre la inversión en activos biológicos y la rentabilidad con el nivel de divulgación, que es mayor para las empresas con inversiones sustanciales en activos biológicos que buscan una mayor transparencia con sus inversores y acreedores en sus decisiones de inversión.

Palabras Clave: Actividad agraria; Activos biológicos; Criterios de valoración; Información financiera; Valor razonable.

1. Introduction

Applying the measurement and disclosure criteria for biological assets to prepare financial information that is useful for users in their decision-making has been a complex issue for those responsible for preparing financial statements. Studies highlight the challenge of measuring biological assets by local standards and the IASB-issued IAS 41. This challenge stems from the intricate nature of measuring the transformation and growth of living plants or animals that constitute biological assets and their fair value-based valuation. This complexity implies a challenge in estimating reliable values in the market (Ceriani and Vigil, 2014; Creţu *et al.,* 2014). In addition, it is essential to ensure proper management of and accounting for the biological assets for the recognition, fair value or cost measurement, and disclosure criteria, as pointed out by the studies of Díaz-Córdova *et al.* (2024) and Kıllı and Kefe (2024).

Some studies say that using fair value to measure biological assets is helpful and positively impacts results. Other studies say companies have trouble measuring how the asset changes biologically and getting accurate market prices. They also say that it's hard to predict how much money crops will bring in the future and that price changes can make it difficult to know whether they made a profit or lost money through market value measurement (Díaz-Córdova *et al.*, 2024; Maldonado *et al.,* 2018; Maruli and Farahmita, 2011). This study emphasizes the research challenge of measuring and disclosing biological assets. According to research, companies aim to increase their financial transparency to shareholders to aid decision-making and minimize agency costs. The 'Big Four' audit firms influence such disclosure (Altarawneh, 2023; Selahudin *et al.,* 2018).

This study is important because it looks at how IAS 41, which has been in effect since 2003, is used in Peru and Chile to measure and report biological assets for businesses. Both countries have similar IFRS adoption processes. The Peruvian Accounting Standards Council (CNC) and the Securities Market Superintendency (SMV) regulated the full adoption of IFRSs in Peru, including incorporating IAS 41. Thus, these entities required listed companies to present their 2012 financial statements under IFRS mandatorily. The Chilean Securities and Insurance Superintendency (SVS) and the Chilean Association of Professional Licensed Accountants regulated the full adoption of IASB-issued IFRSs. They established a comprehensive and explicit adoption of IFRS, with early adoption of the 2009 financial statements and mandatory adoption as of 2013 (Espinosa *et al.,* 2015).

The agricultural activity in Peru and Chile is also relevant because it is one of the fastest-growing sectors, favorably contributing to each country's economy with exports and consumption. In Peru, in 2022, agricultural activity was the fourth activity with the highest export volume of US$1,354 million, increasing by 54% compared to 2021 and accounting for 2.01% of total exports according to the Instituto Nacional de Estadística (INEI) (2022). Agriculture was the third activity in Chile, with the highest export volume of US$13,312 million in 2022, increasing by 3.5% compared to 2021 and accounting for 13.7% of total exports (Banco Central de Chile, 2022).

Based on the above, the following research question arises: What is the measurement

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model and level of compliance with the biological asset disclosure criteria and their determinants under IAS 41 for Peruvian and Chilean listed companies?

2. Background

In Latin America, research on IAS 41 has explored the use of fair value and historical cost criteria to determine the valuation of biological assets and agricultural products across various farming activities and industries (Herrera Freire *et al.,* 2021; Peña-Breffe, 2019; Marrufo and Cano, 2021). Additionally, several studies have examined the disclosure criteria, finding that these often fail to meet all transparency requirements and objectives due to the significant costs involved in their development (Ganassin *et al.,* 2016; Menezes and Ciampaglia, 2023; Monico *et al.,* 2020; Nardi and Da Silva, 2023).

2.1. Measurement Criteria

Research has highlighted the diverse approaches used in selecting measurement models for biological assets. Studies show that the historical cost criterion is more objective, verifiable, and adopts a conservative approach. This method reduces the likelihood of management altering the valuation, which is advantageous for shareholders, as it minimizes volatility in market value estimates. However, the cost model presents challenges, particularly in the valuation of production costs and the allocation of indirect costs (Argilés and Slof, 2001; Campos *et al.,* 2018; Silva-Filho *et al.,* 2013).

On the other hand, when management estimates fair value based on active market prices, it offers investors and shareholders higher quality information, thereby reducing information asymmetry and agency costs (Díaz-Córdova *et al.,* 2024; Nardi and Da Silva, 2023; Gómez *et al.,* 2011; Nakasone and Castillo, 2023). Similarly, Gonçalves *et al.* (2017)+ suggest a positive relationship between the fair value measurement of biological assets and the firm's stock market value.

However, those in charge of financial reporting choose to continue applying the historical cost model due to problems measuring at market value, such as the determination of discounted net future cash flows. This requires complex estimates of budgets and discount rates, resulting in higher measurement costs than benefits, according to Maldonado *et al.* (2018) and Ndala (2018).

Another aspect to keep in mind is the limited comparability of financial information across agricultural companies that choose to measure their biological assets at different fair value estimates, such as active or similar market prices or discounted cash flow estimates, which IAS 41 and IFRS 13 establish as levels of fair value hierarchies (Oliveira *et al.,* 2015; Silva-Filho *et al.,* 2013).

The studies address the issue of fair value measurement models based on projected prices and discounted flows for Chilean forestry companies, which require uniform methodological and measurement criteria (Acuña *et al.,* 2020; Morales and Hollander, 2018). The descriptive research of Hernández *et al.* (2017) examines the biological assets of Peruvian and Chilean companies. It emphasizes the importance of agricultural companies in applying the fair value measurement criteria under IAS 41. However, there is a lack of uniform estimation and measurement criteria at the companies.

Research suggests that certain corporate factors influence the choice of measurement models. In this regard, the use of a fair value model would provide greater reliability of information for shareholders and creditors. One of the key factors is the type of audit firm. Studies indicate that the largest auditing firms, known as the 'Big Four,' ensure more reliable financial information when applying the fair value model. Additionally, the type of biological asset, agricultural activity, and agricultural produce market play a crucial role in determining the more accurate application of the fair value model (Atanasovski, 2013; Selahudin *et al.,* 2018).

Ultimately, the choice of the fair value model is affected by the accessibility of active or comparable markets and the availability of financial information for estimating the asset's fair value using discounted cash flows at various stages of its growth (Ceriani and Vigil, 2014; Creţu *et al.,* 2014; Hernández *et*

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al., 2017; Maldonado *et al.,* 2018). Based on the above literature review, the following hypotheses are proposed:

H1: The type of agricultural produce significantly influences the choice of measurement model.

H2: The type of audit firm significantly influences the choice of measurement model.

2.2 Disclosure criteria

Studies on IAS 41 also consider the level of compliance with financial information disclosure among its users, as well as the factors that determine this compliance. The first variable influencing the level of disclosure is the type of biological asset and agricultural activity, which varies based on whether the assets involve living animals or plants. Similarly, the distinction between agricultural companies that solely sell agricultural produce and agro-industrial companies that engage in production processes for their finished products also affects the level of disclosure. The type of biological asset influences disclosure through varying measurement criteria. Different approaches, such as historical cost estimates or market prices (limited by value volatility), or discounted cash flow estimates based on plantation type, are required to meet these criteria (Baigrie and Coetsee, 2016; Elad and Herbohn, 2011; Maldonado *et al.,* 2018; Gonçalves and Lopes, 2015). Consequently, the following hypothesis is proposed:

H3: The level of compliance with disclosure under IAS 41 significantly varies according to the type of biological asset produced by the company.

Previous research has examined the impact of audit firm size on the level of financial disclosure, consistently finding that larger audit firms tend to promote higher compliance with disclosure requirements and transparency. This, in turn, provides key stakeholders such as shareholders and creditors with more reliable and relevant information for decision-making. Additionally, larger audit firms help reduce agency costs and mitigate information asymmetry between management and investors (Altarawneh, 2023; Gonçalves and Lopes, 2014; Monico *et al.,* 2020; Oliveira and Silva, 2023; Renata *et al.,* 2024). Based on these findings, the following hypothesis is proposed:

H4: The level of compliance with disclosure under IAS 41 significantly varies depending on the type of audit firm overseeing the financial statements.

Another variable positively associated with the level of financial disclosure is company size. According to agency theory, managers in larger companies, which are better equipped to absorb the costs of preparing comprehensive financial reports, are more likely to ensure that biological assets are disclosed in the financial statement notes with higher quality and in full accordance with regulatory standards (Altarawneh, 2023; Dias *et al.,* 2020; Gonçalves and Lopes, 2015; Mirović *et al.,* 2019; Selahudin *et al.,* 2018). Consequently, the following hypothesis is proposed:

H5: Company size is positively and significantly correlated with the level of compliance in the disclosure of biological assets.

Investment in biological assets has also been identified as a relevant factor, specifically the percentage of biological assets relative to a company's total assets. Studies suggest a positive correlation between this variable and the level of information disclosure. Companies with higher investments in biological assets tend to disclose more regulatory compliance information, which is beneficial for financial statement users (Altarawneh, 2023; Bagudo and Shuaibu, 2021; Gonçalves and Lopes, 2014; Mirović *et al.,* 2019; Oliveira and Silva, 2023; Renata *et al.,* 2024). Accordingly, the following hypothesis is proposed:

H6: Investment in biological assets is positively and significantly correlated with the level of compliance in the disclosure of biological assets.

Lastly, regarding the relationship between company profitability and disclosure levels, existing research indicates that disclosing biological asset information can incur substantial costs. More profitable companies are therefore more likely to have the resources to bear these costs. Furthermore,

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Gonçalves and Lopes (2014) and Selahudin *et al.* (2018) suggest that positive financial performance may facilitate more informed investment decisions. However, other studies do not always support a positive relationship. For example, Gonçalves and Lopes (2015) and Santos *et al.* (2014) found that less profitable companies might disclose more information to attract financing, whereas more profitable companies may reduce their level of disclosure as part of their public information strategy. Similarly, Ika *et al.* (2023) found no significant relationship between investments in biological assets and the financial performance or value of agricultural companies. Based on these findings, the following hypothesis is proposed:

H7: The level of compliance in the disclosure of biological assets is significantly correlated with company profitability.

3. Research Method

This research employs a quantitative approach, a relational scope, and a non-experimental and cross-sectional design through a content analysis of Peruvian and Chilean listed companies' financial statements for 2021-2022 using IAS 41. The relational analysis included the Chi-Square test to analyze the influence of the country, audit firm, and type of agricultural produce on the cost or fair value measurement model. Similarly, we applied the one-factor ANOVA test to assess how the categorical variables of country, audit firm, and produce type influenced the level of compliance with disclosure criteria. This test was applied considering that the continuous variable follows a normal distribution according to the Shapiro-Wilk test for samples of less than 50 cases. Finally, the Pearson correlation test was used for the continuous variables of company size, investment in biological assets, profitability, and level of compliance with disclosure criteria. SPSS 29 software was used for the above tests.

To analyze the disclosure level, the disclosure criteria under IAS 41 described below were considered. It was first used an ordinal scale to rate the level of compliance: 0 means the company does not disclose any criteria, 1 means the disclosure is only a brief narrative mention, 2 means the disclosure includes details and analysis, and 3 means the disclosure includes a full narrative explanation and quantitative data. The average was then found to be a variable level of compliance with disclosure criteria.

Disclosure criteria of the fair value model according to IAS 41:

- Disclosure of the aggregate gain or loss arising during the current period on initial recognition of biological assets and agricultural produce.
- Disclosure of a description of each group of biological assets.
- Disclosure of the nature of the activities involving each group of biological assets.
- Disclosure of non-financial measures (or estimates) of the physical quantities of each group of the biological assets at the end of each period and output of agricultural produce during the period.
- Disclosure of the existence or carrying amounts of biological assets whose title is restricted.
- Disclosure of the amount of commitments for the development or acquisition of biological assets.
- Disclosure of financial risk management strategies related to agricultural activity.
- Presentation of a reconciliation of changes in the carrying amount of biological assets between the beginning and the end of the current period.

Additional disclosure criteria for the historical cost model according to IAS 41:

- An explanation of why fair value cannot be measured reliably.
- Disclosure of the range of estimates within which fair value is highly likely to lie and description of the method used (depreciation, impairment).
- Disclosure of any gain or loss recognized on disposal of biological assets and effects on depreciation and reversals of impairment losses.

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- Disclosure of fair value measurement of biological assets previously measured at cost.

It should be emphasized that the variables of measurement and disclosure criteria of Peruvian and Chilean companies were based on the study conducted by Hernández *et al.* (2017), to which the variables representing the determinants of the measurement and disclosure criteria have been added in this research. According to the cited authors, Table 1 describes the measurement criteria.

The study looked at a non-random sample of companies from the Peruvian and Chilean stock markets that used IAS 41 to report their biological assets in their 2021–2022 financial statements. These companies were found by the Securities Market Superintendency (SMV) and the Chilean Financial Market Commission (CMF). The final sample included 12 Peruvian and 18 Chilean companies. Companies undergoing financial restructuring and that did not present their financial statements for the years under study were excluded. Table 2 describes the sample, including the company name, biological asset type, and measurement criteria.

Table 1. Description of Variables

Variable	Measurement Criterion	Citations
Type of biological asset and agricultural activity	Categorical variable for each type of agricultural produce: sugarcane, meats, fruit, pine, salmon, and grape.	Maldonado *et al.* (2018); Creţu *et al.* (2014). Baigrie and Coetsee, 2016; Elad and Herbohn, (2011); Gonçalves and Lopes (2015).
Type of auditor	Dichotomous variable with a value of 0 if the audit firm is not a Big Four firm and a value of 1 if the audit firm is a Big Four firm.	Bagudo and Shuaibu (2021), Altarawneh (2023); Gonçalves and Lopes, (2014); Monico *et al.* (2020); Oliveira and Silva (2023); Renata *et al.* (2024); Selahudin *et al.* (2018).
Company size	Ln of total value of assets in 2022 (in thousands of US dollars)	Altarawneh (2023); Dias *et al.* (2020); Gonçalves and Lopes, (2015); Mirović *et al.* (2019); Selahudin (2018).
Investment in biological assets	Percentage of biological assets in relation to total assets	Altarawneh (2023); Bagudo and Shuaibu (2021); Gonçalves and Lopes (2014); Mirović *et al.* (2019); Oliveira and Silva (2023) ; Renata *et al.* (2024).
Profitability	2021 return on equity (ROA): Net income/equity	Gonçalves and Lopes, (2014); Gonçalves *et al.* (2017); Mirović *et al.* (2019).
Country (control variable)	Control variable of the study, dichotomous with a value of 1 if the it is a Peruvian company and a value of 2 if it is a Chilean company	Hernandez *et al.* (2017).

Source: Authors' own elaboration. Prepared on the basis of the literary review.

Table 2. Samples of Companies in the Study

Company	Country	Main Biological Asset & Agricultural Activity	Measurement Model & Technique
Agro industrial Paramonga S.A.A.	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Agroindustrial Laredo S.A.A.	Peru	Sugarcane plantation and sugar industry	Cost method. Production cost measurement
Agroindustrias San Jacinto Sociedad Anonima	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Cayaltí Agricultural S.A.A.	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Cartavio Open Joint Stock Company	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows

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Casa Grande Sociedad Anónima Abierta	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Chucarapi Pampa Blanca S.A. sugar mill.	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Chiquitoy S.A. Agricultural Company.	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Empresa Agrícola San Juan S.A.	Peru	Grape and sugarcane for sale	Fair market value through discounted cash flows
Sintuco Agricultural Company S.A.	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Empresa Agroindustrial Pomalca S.A.A.	Peru	Sugarcane plantation and sugar industry	Cost method. Production cost measurement
El Ingenio S.A. Sugar Company.	Peru	Sugarcane plantation and sugar industry	Fair market value through discounted cash flows
Empresas Iansa S.A.	Chile	Beet plantation for sugar production, fruit plantation for canned food, and animal feed production.	Beet measured at historical cost as a principal biological asset and fruit measured at fair value through discounted cash flows
Hortifrut S.A.	Chile	Fruit plantation for sale and agro-industry	Fair value through average historical sales price
Fruticola Viconto S.A.	Chile	Fruits	Cost method. Production cost measurement
Agrosuper S.A.	Chile	Poultry, Pigs and Salmon	Poultry and pigs are measured at production cost, and salmon is measured at fair value through discounted cash flows.
Viña San Pedro Tarapacá S.A.	Chile	Grape	Cost method. Production cost measurement
Viña Concha y Toro S.A.	Chile	Grape	Fair value of grapes at harvest
Viña Los Vascos S.A.	Chile	Grape	Cost method. Production cost measurement
Sociedad Anónima Viña Santa Rita	Chile	Grape	Cost method. Production cost measurement
Watts S.A. and subsidiaries	Chile	Grape	Fair value of grapes at harvest
Invertec Foods S.A.	Chile	Fruits	Fair value through average selling price
Aquachile S.A. Companies	Chile	Salmon	Fair market value through discounted cash flows
Antarchile S.A.	Chile	Pine	Fair market value through discounted cash flows
Blumar S.A.	Chile	Salmon	Fair value taking into account estimated prices, costs and volumes
Camanchaca S.A.	Chile	Salmon	Fair value taking into account estimated prices, costs and volumes
Empresas CMPC S.A.	Chile	Pine	Fair market value through discounted cash flows
Osorno Fair S.A.	Chile	Meats	Fair value. Prevailing market selling prices
Multiexport Foods S.A.	Chile	Salmon	Fair value taking into account estimated prices, costs and volumes
Viñedos Emiliana S.A.	Chile	Grape	Fair value of grapes at harvest

Source: Authors' own elaboration prepared on the basis of the financial statements of the sample.

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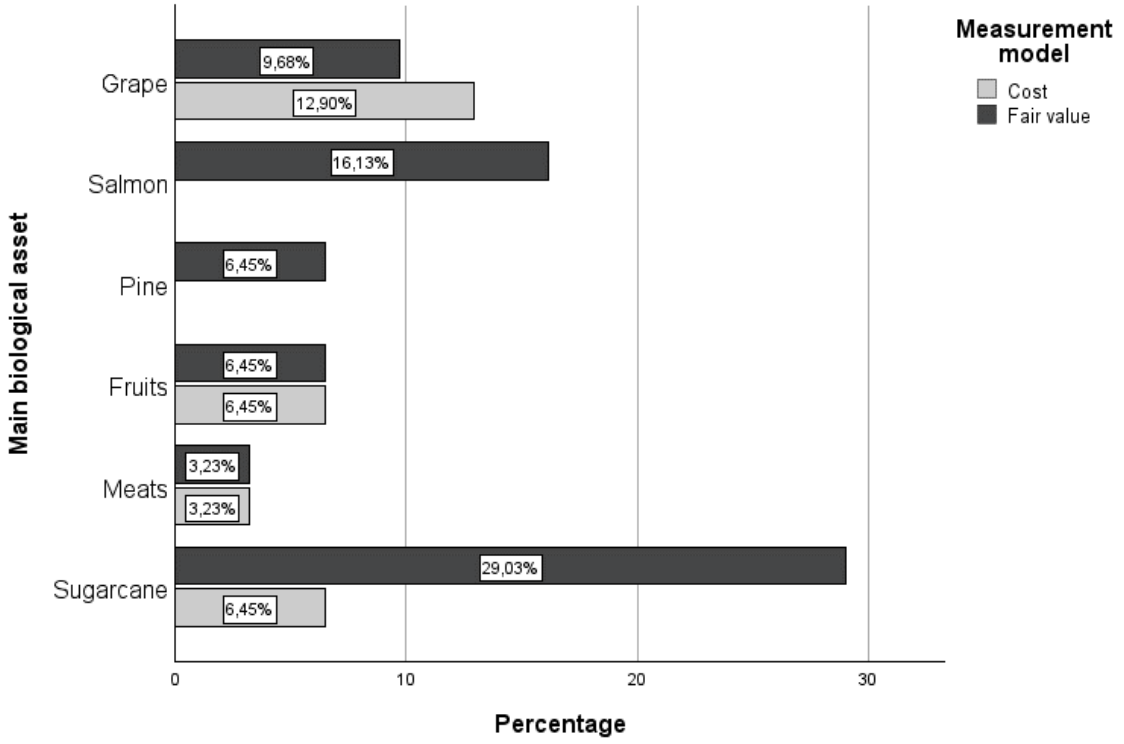
Figure 1. Measurement model by type of biological asset



Source: Authors' own elaboration.

4. Results

4.1 Measurement Criteria

Figure 1 illustrates the application of the fair value model to all types of biological assets, primarily for grape, salmon, pine, and sugarcane produce. For Peruvian sugarcane companies, the fair value estimation was based on discounted cash flow estimates.

Other Chilean pine and salmon production companies that applied the fair value model considered market price estimates and discounted cash flows. The livestock, poultry (meat), and fruit industries apply to the same extent both production historical cost or fair value models based on estimated prices and discounted cash flows. Finally, when it becomes impractical to reliably determine the fair value, the grape production industry applies the fair value model based on market prices or the production cost criterion.

4.2. Disclosure Criteria

Figure 2 displays the disclosure level results for companies that use the fair value model for their primary biological assets. The most disclosed information, with a mean of more than 2, includes the description and nature of each biological asset group's activities, as well as financial risk management strategies related to the agricultural activity. On the other hand, the least disclosed, with a mean of less than 2, are non-financial measures of the physical quantities, gain or loss from changes in fair value, reconciliations of carrying amounts, and infrequent ownership restrictions and commitments.

Companies that use the cost model for their biological assets have less information shared (Figure 3). It only shows the type and description of agricultural activities, as well as price and market financial risk management strategies, with a mean value higher than 2. The low disclosure level, less

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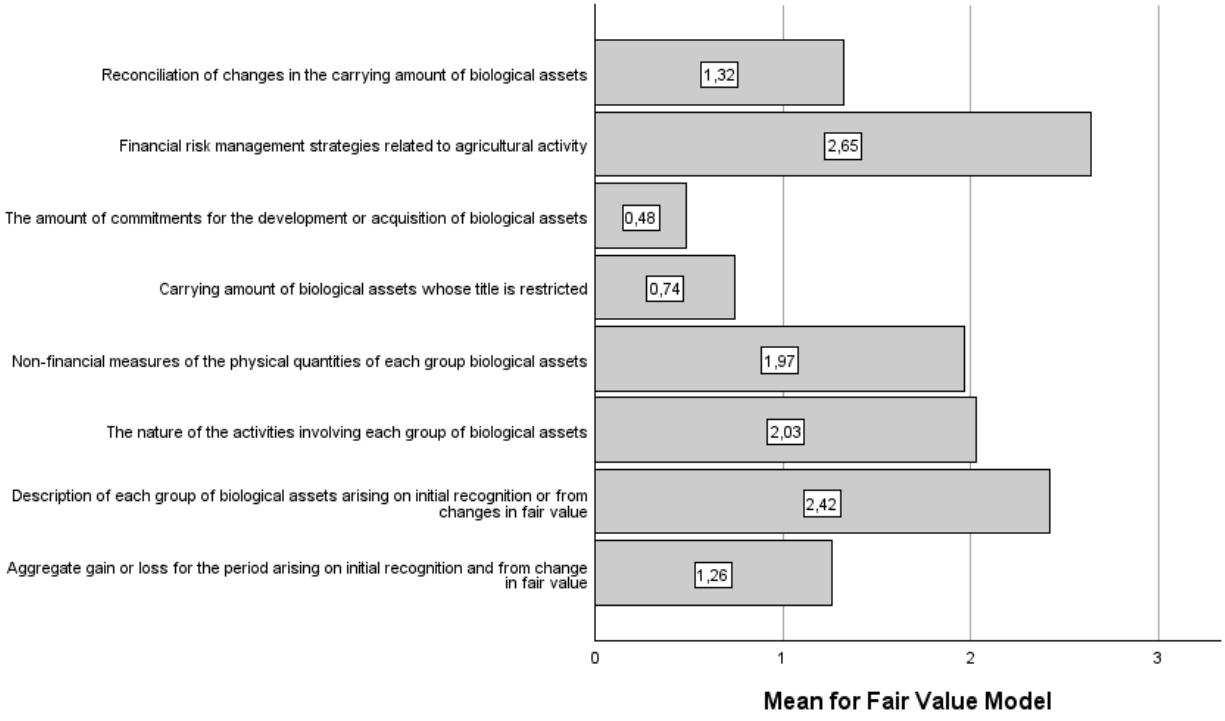
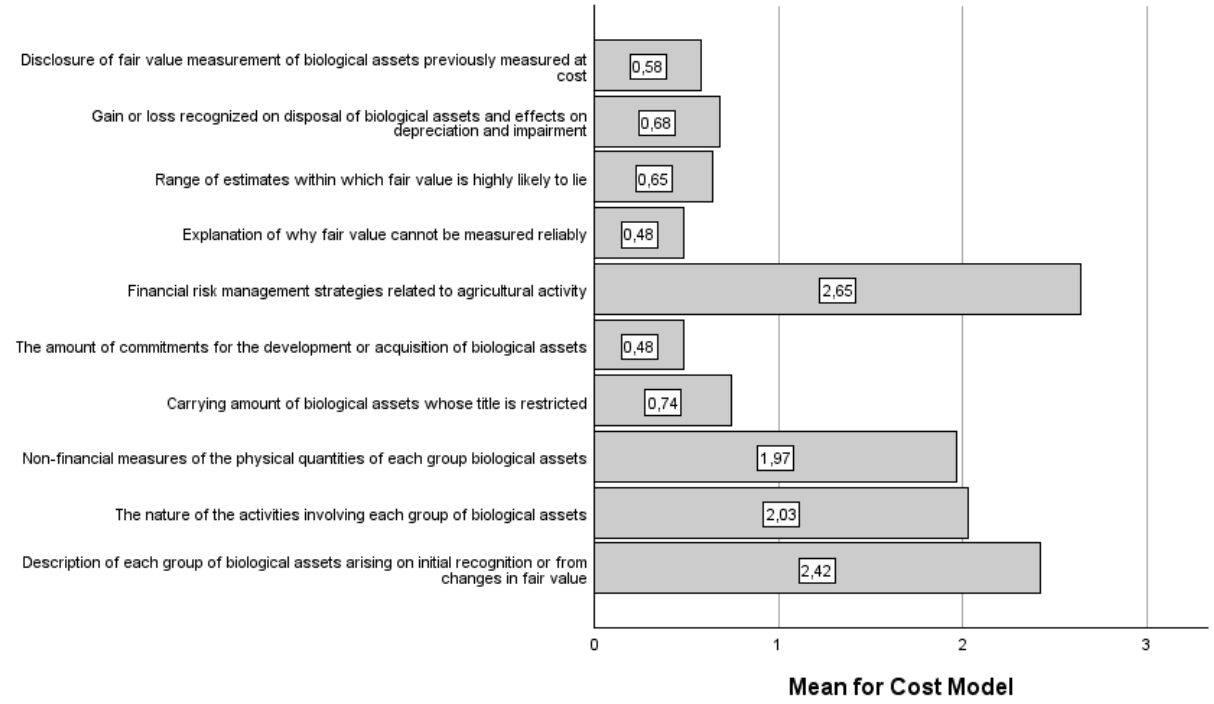
Figure 2. Disclosure Level for Companies that Apply the Fair Value Model



Source: Authors' own elaboration.

Figure 3. Level of Disclosure for Companies that Apply the Cost Model



Source: Authors' own elaboration.

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Table 3. Chi-Square Test for Influence on Measurement Model

Test variable	Test variable categories	Cost Model	Fair Value Model	Total	Chi-Square
Country	Peru	2	10	12	χ^2= 0.854
		16.7%	83.3%	100.0%	p value 0.355>0.05
	Chile	6	13	19	
		31.6%	68.4%	100.0%	
	Total	8	23	31	
Audit firm	No Big Four	2	7	9	χ^2= 0.085
		22.2%	77.8%	100.0%	p value 0.771>0.05
	Big Four	6	16	22	
		27.3%	72.7%	100.0%	
	Total	8	23	31	
Main produce	Sugarcane	2	9	11	χ^2= 5.666
		18.2%	81.8%	100.0%	p value 0.340>0.05
	Meats	1	1	2	
		50.0%	50.0%	100.0%	
	Fruits	2	2	4	
		50.0%	50.0%	100.0%	
	Pine	0	2	2	
		0.0%	100.0%	100.0%	
	Salmon	0	5	5	
		0.0%	100.0%	100.0%	
	Grape	3	4	7	
		42.9%	57.1%	100.0%	
Total		8	23	31	

Source: Authors' own elaboration obtained from analysis using SPSS 29.

than a mean of 1, highlights the lack of disclosure of reasons for not implementing the fair value model and its likely estimation. The disclosure of any gain or loss on disposal of biological assets, changes in the fair value model, and commitments and restrictions for biological assets is infrequent.

4.3. Relational Analysis

For the analysis of influence on the measurement model, a Chi-square test was applied, as exhibited in Table 3. The cross tables show that the variables of country, type of audit firm, and type of biological asset do not significantly influence the measurement model, i.e., no significant difference is found in the application of the measurement model. In all cases, the proportion of the company by country, type of audit firm, and nature of the biological asset is greater or equal for those companies that apply the fair value model. Significant values greater than 0.05 suggest the rejection of the hypothesis that the country, type of audit firm, and type of produce significantly influence the measurement model.

Regarding the influence of country, type of audit firm, and type of produce, a one-factor ANOVA test was applied to see if there

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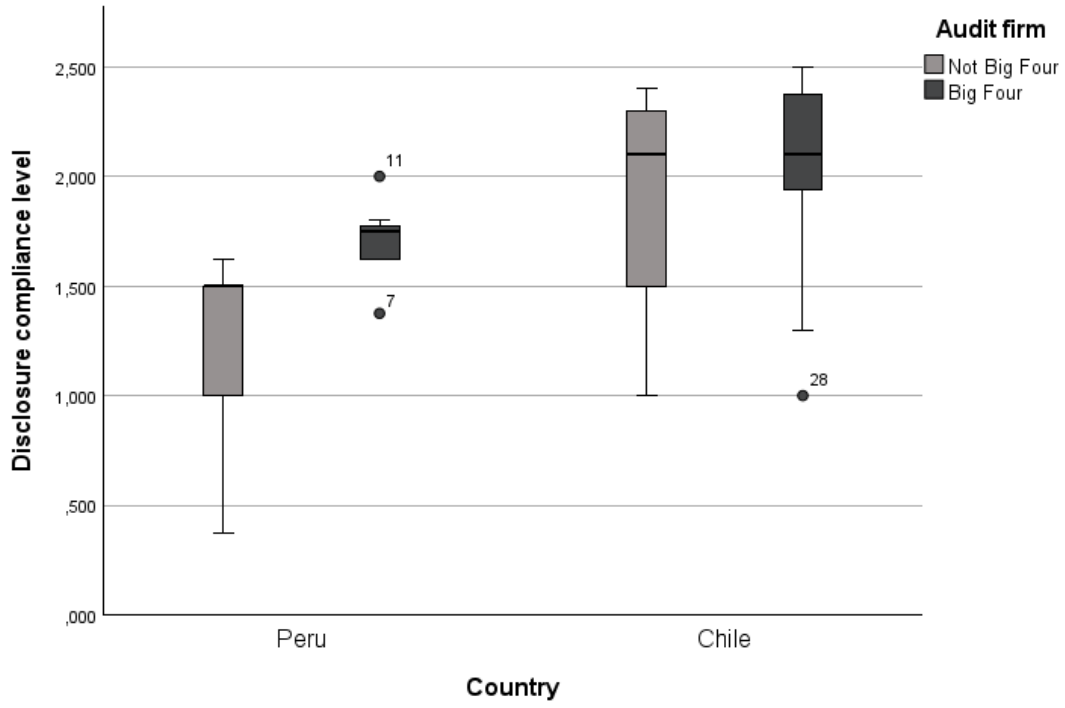
is a difference in the means of the level of disclosure compliance as hypothesized. Figure 4 displays the box plot of disclosure compliance means by country and type of audit firm, revealing differences. In particular, the mean disclosure compliance is higher for Chilean companies, primarily those involved in the production of pine, export fruit, and salmon. Likewise, disclosure compliance is higher for those audited by a 'Big Four' audit firm in both countries.

The ANOVA test showed a p-value of 0.03<0.05 for the significance value of difference in means by country, thus accepting the hypothesis of a significant influence of the country on the disclosure level. For the influence of the type of audit firm, there is also a significant difference with a p-value of 0.029<0.05, thus accepting the hypothesis of a significant difference in the disclosure level according to the type of audit firm, i.e., it is higher for the companies audited by a 'Big Four' audit firm. Considering the type of biological asset of the agricultural activity of the companies, Figure 5 of the box plots shows significant differences in the disclosure level with a p-value of 0.018<0.05, so the hypothesis of a significant difference in the disclosure level by type of biological asset is also accepted. As mentioned, the pine, salmon, export fruit, and meat production provides more information on biological assets, production activities, physical measures, fair value estimates, and details of accounting movements for the period.

We performed a Pearson correlation test to analyze the correlation between the company size, asset size, percentage of investment in biological assets, return on equity (ROE), and the disclosure compliance level. Table 4 shows that there was a strong and positive relationship (with a significance level of less than 0.05) between the percentage of investment in biological assets, the level of disclosure, and the company's profitability. This supports hypotheses 6 and 7: the higher the level of disclosure, the higher the investment in biological assets, and the higher the company's profitability.

Figure 4. Disclosure Compliance Level by Country and Type of Audit Firm



Source: Authors' own elaboration.

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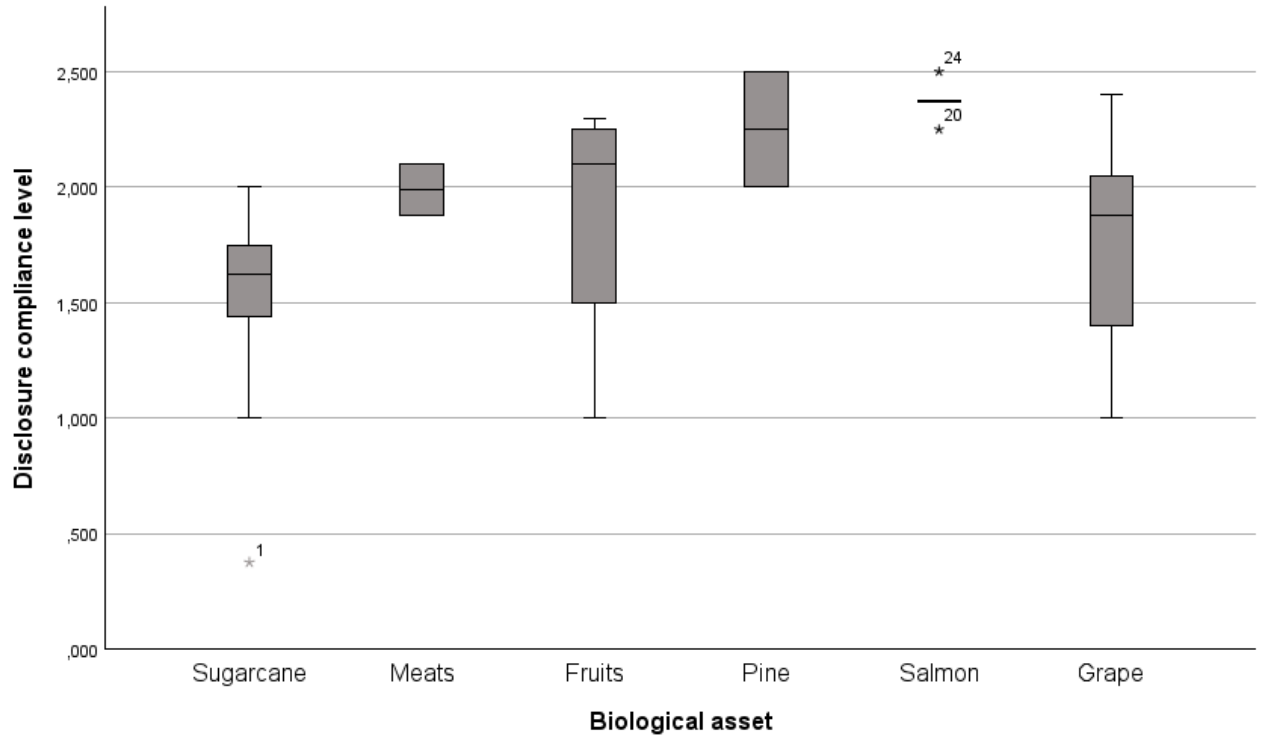
Figure 5. Disclosure Compliance Level by Type of Biological Asset



Source: Authors' own elaboration.

Table 4. Pearson Correlation Test for Continuous Variables

Variables	Statistics	LnSize	Investment in Biological Assets	ROE	Disclosure Level
LnSize	Pearson correlation	1	-0.112	0.061	0.314
	Sig. (bilateral)		0.550	0.743	0.085
Investment in	Pearson correlation	-0.112	1	0.343	,357*
biological assets	Sig. (bilateral)	0.550		0.059	0.049
ROE	Pearson correlation	0.061	0.343	1	,374*
	Sig. (bilateral)	0.743	0.059		0.038
Disclosure Level	Pearson correlation	0.314	,357*	,374*	1
	Sig. (bilateral)	0.085	0.049	0.038	

* Sig. < 0.05 (bilateral).

Source: Authors' own elaboration obtained from analysis using SPSS 29.

5. Discussion

The study results reveal that the fair value model is the most commonly used measurement criterion in both the studied countries. The research fails to demonstrate the hypothesis that the country, type of audit firm, and nature of biological assets influence the measurement model they use. Both Peruvian and Chilean companies apply

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the fair value criterion to most agricultural activities that produce assets like pine, cane, salmon, and grapes. These activities allow for the reliable estimation of market prices or discounted flows, thereby providing users with more reliable information (Argilés *et al.,* 2011; Nardi and Da Silva, 2023; Gómez *et al.,* 2011; Silva-Filho *et al.,* 2013). The few companies that apply the cost model do so because they consider that price information and data to estimate discounted flows as fair values cannot be reliably obtained (Bohušová *et al.,* 2012; Ceriani and Vigil, 2014).

There isn't full compliance with the standard's disclosure requirements, but companies that are more open and use the fair value criterion give enough information about their farming activities, including physical measurements, balances, changes in the fair value of biological assets, and the financial risks that come with the farming. The companies that apply the cost model also report, with a lower disclosure level, the details and measures of biological assets. However, in all cases, they do not explain the reasons for not applying the fair value and probable estimate. This indicates that some companies may improve their transparency policies with their investors and creditors if they have more knowledge of the standard and more available resources to do so (Ganassin *et al.,* 2016; Menezes and Ciampaglia, 2023; Nardi and Da Silva, 2023).

Regarding the analysis of disclosure level determinants, this study finds a significant influence of the type of audit firm, i.e., the companies audited by 'Big Four' audit firms have a higher disclosure level to reduce agency costs with information users (Altarawneh, 2023; Gonçalves and Lopes, 2014; Monico *et al.,* 2020; Renata *et al.,* 2024). Accordingly, based on the agency theory, the hypothesis that the companies with higher investments in biological assets and more profitability also have a higher disclosure level was accepted. This significant correlation is explained in the sense that those responsible for financial information seek greater transparency to decrease the asymmetry of information with investors and creditors in their investment decisions favorable to the companies (Altarawneh, 2023; Gonçalves and Lopes, 2014; Mirović *et al.,* 2019).

Finally, one of the main findings of this study is that the type of biological asset and agricultural activity significantly influence the level of transparency according to the requirements of IAS 41. The Chilean companies engaged in activities such as pine, salmon, fruit, poultry and pig production for local consumption and export have a higher disclosure level related to the detail of activities, physical data, and fair value estimates of more complex discounted flows and market prices specific to the industry and information for financial risk analysis, with greater transparency for users (Baigrie and Coetsee, 2016; Elad and Herbohn, 2011; Maldonado *et al.,* 2018; Gonçalves and Lopes, 2015; Creţu *et al.,* 2014).

6. Conclusions

Over a decade after the initiation of IFRS adoption in Peru and Chile, our findings suggest growing familiarity with and adherence to IAS 41 among listed companies, and the results allow us to conclude that there is more experience and a greater tendency to consider the criteria of IAS 41. The presence of large audit firms, the nature of biological assets, and the level of investment therein significantly impact the application of fair value measurement. This heightened transparency regarding market values of biological assets and agricultural produce contributes to improved disclosure compliance. Consequently, stakeholders benefit from enhanced financial decision-making, reduced agency costs, and potentially more efficient value markets.

A limitation of this study is the exclusive focus on listed companies. Access to financial information from unlisted and smaller agricultural entities (e.g., SMEs) would have enabled a broader sample, potentially yielding richer insights and facilitating recommendations for IFRS implementation in diverse contexts.

This study underscores the need for further research on IAS 41 implementation across a wider range of agricultural companies in Latin America, including unlisted and smaller entities. Comparative analyses could shed light on regional variations in practice. Moreover, qualitative research

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exploring the decision-making processes behind measurement and disclosure choices would provide valuable insights for standard-setters and practitioners alike.

7. Conflict of Interest

The authors declare that they have no conflict of interest.

8. Funding Resources

This study had no funding resources.

9. References

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