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ACCOUNTING CHALLENGES IN MEASURING BIOLOGICAL ASSETS ACCORDING TO IAS 41: A CASE STUDY IN WASIT GOVERNORATE

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Abstract. The core objective of this study is to identify the practical and conceptual accounting issues encountered when assessing biological assets in accordance with International Accounting Standard 41 (IAS 41: Agriculture) for the livestock industry in Wasit Governorate, Iraq. The biological assets mentioned herein refer to economically viable living assets such as live livestock in the local livestock industry. The international accounting standard referenced is IAS 41, which is specifically formulated for the agricultural sector. The identified issues include both operational difficulties encountered in actual assessment operations and challenges arising from unclear understanding of the concepts of the standard itself. The study adopts a descriptive analytical framework, and the core dataset incorporates two categories of data simultaneously: one is the primary raw data collected through field interviews, and the other is the secondary collated data extracted from financial statements and administrative reports. In simple terms, these two types of data cover the first-hand information directly obtained from front-line practitioners, and also collate various past records stored in existing official documents, with information from both aspects is combined for analysis. The analysis results show that the local industry's compliance with the IAS 41 standard has consistently remained at a low level. There are three underlying reasons: first, most practitioners do not have access to a usable accounting information system, lacking even the basic system support for standardized bookkeeping and accounting; second, internal accounting personnel have a severe lack of IFRS-related knowledge, and have insufficient understanding of the requirements of this set of international financial reporting standards; third, the value assessment models that have always been used by all parties have chaotic standards, with no unified pricing framework, and the two measurement methods of historical cost and fair value are mixed, that is, the original cost spent on purchasing the livestock initially and the current market price at which the batch of livestock can be sold in the current market are used at the same time. The two pricing scales cannot be unified, so naturally the requirements of the standard cannot be met. The paper also highlights the regulatory lacuna in Iraq due to old accounting laws that have not been updated since 1979. We suggest updating the local regulatory framework, making it mandatory to assess fair value in the whole process of biological transformation in all stages and improving professional training of accounting personnel.

Keywords: IAS 41, Biological Assets, Biological Transformation, Agricultural Accounting, Wasit Governorate, Iraq.

Introduction

Both enterprises and countries see agriculture as an important activity as it offers material benefits that ensure the enterprise can sustain its business operations and contribute to the country's various sectors (services and manufacturing) and overall GDP. IAS 41 (International Accounting Standard 41) provides the framework for the accounting treatment, presentation, and disclosure requirements pertaining to the agricultural activities. For the purposes of IAS 41, agriculture refers to the management of biological assets' growth to be converted to agricultural produce, or to be further developed as biological assets to be harvested for other future benefits. Therefore, agriculture activities generally involve the management of labor efforts in biological assets to achieve future financial benefits, manifested as produce or as a growing biological asset. Managing agricultural activities effectively encompasses many different actions, including but not limited to, cultivation, harvesting, pruning, husbandry, and feeding. Managing biological assets, in essence, is the control of the economic benefits that can be expected from these biological assets, for which benefits can be received in the form of agricultural produce, as well as from the services associated with the use of such biological assets, which contributes to the overall economic value of the agricultural enterprise. [1], [2]

Overview of IAS 41

Agriculture is a fundamental activity both socially and economically, and most especially in developing nations like Indonesia [3]. Not only does agriculture produce food, but also other necessities of society like raw materials, fuels, and fibers. In addition to these functions, agriculture also provides a wide range of employment opportunities, particularly in rural areas [4]. Greater employment opportunities help to diversify agriculture, and provide food security to the growing population.

The agricultural marketing system provides a vital link that connects agricultural producers to consumers, and also to other industries that use agricultural products, especially in Indonesia [5]. Agriculture, in the context of Indonesia, is seen as a result of the balanced relationship between the various inputs and outputs of the farming as well as the levels of advanced marketing and trade. This relationship creates additional value that benefits the economy of the nation and the people. Within the Agriculture as a sector, the various components and linkages demonstrate the importance of the sector in the economic growth and the people livelihood improvement in the developing economy like Indonesia [6].

Biological Assets Defined

IAS 41 explains biological assets in detail as they pertain solely to the standards applicable to the IAS 41. Following IAS 41's provisions, a biological asset can be categorized as any living thing, whether animal or plant. From a practical standpoint, biological assets are identified with value in terms of the economic benefits they are expected to produce. The availability of this value anchors much of the agriculture accounting framework. The classification of biological assets extends to living plants, including timber, fruit trees, and oil palm. Also included in this classification are all types of livestock such as cattle, sheep, and fowl. Additionally, biological assets also include all types of crops grown for commercial agriculture; such an asset classification shows its breadth and economic value. [7], [8], [9]

Although the net present value of productive forests has the potential to change the total market value of forest land, it should be emphasized that the provisions of IAS 41 mainly focus on biological assets, and as such, do not directly relate to land value. Hence, biological assets should be governed by the provisions of IAS 41 even where economic relations and land value considerations are relevant to such assets.

There are no issues about these biological assets which are specifically meant to be harvested or sold and these clearly fit into the scope of the standard. This critical delineation provides for the recognition of the relation of land to biological assets, but within the IAS 41 instructions, biological assets are given the greatest importance in their determinations and assessments. Thus, the valuation of land is left to other relevant standards and regulations, instructions, and guidelines which are distinct and separate in providing the valuation of biological resources to ensure that nothing is overlooked in regard to each of the components. This is especially

important for forest resource management and the financial intricacies associated with forest land and its production potential. [2], [8], [10], [11], [12]

Importance of Measuring Biological Assets

Intrinsic value is added to living plants and animals described as biological assets [13]. Biological assets must be recorded and measured according to value in market practice according to. measured below cost, measured value is market losses. Typically biological Measured value is subjective preset cost of sale. losses or losses recorded profit and transparency of show value credit measured value investors and of biology economy of reporting business [14]

In the measured measured of business value the the market measured value of the measured gained revenue or losses. use of the biological biological of report of use of valuable investments in make disclosures biological on of biologic to use less less value, less value, assure value, reported assure value, financial less value, less value, measured value. [15]

Cited data inconsistencies make it difficult for investors and stakeholders to make informed decisions. [2], [16], [17], [18]

Challenges in Measurement

Challenges in assessing biological assets under IAS 41 include deciding the measurement basis and how to apply the standards. The current agricultural accounting systems include merged financial, cost, and managerial accounting, which reflects the need for several techniques to deal with different agricultural activities [1]. Some professionals argue that IAS 41 should not be applied to all the stages in the life cycle. They propose biological assets should be represented in budgets or consolidated with Standard 1, which most economists think is worth the regulatory changes and cost. Additional concerns about implementation come from the gap between IAS 41 and agricultural accounting. For instance, the TJS Farm case study showed that the historical cost for day-old chicks (DOC) and the fair value for adult birds were applied. Such inconsistencies in regard to recognition, presentation, and disclosure create reliability problems and, therefore, the need for practitioners to improve their grasp of biological assets and IFRS. [19], [11], [20], [21], [22]

The features of biological assets also present a challenge. Since biological assets are living plants or animals, their value changes throughout the life cycle. Because of this, their value can only be assessed through continuous measurement. As a result, this involves even greater exposure to the risks associated with fair value measurement, which for many biolivestock, is a problem (e.g. cattle) [2]. The most significant challenge to the implementation of IAS 41 is the lack of point-of-sale costs, which have transitioned many people from a historical cost perspective to a fair-value perspective.

Since the issuance of the standard by the International Accounting Standard Committee in 2000 and its mandatory application starting in 2003, amendments—especially those in 2009 concerning discount rates and value addition—demonstrate the measurement complexity. The adoption of such fair-value framework often meets institutional resistance, as shown by Indonesia's attempts to adopt IAS 41 with considerable operational disruption. [23], [24], [25]

Valuation Techniques

The evolution of humankind has been deeply entwined with the challenges and opportunities presented by agriculture. Agriculture still contributes in many substantial ways through foreign exchange, various forms of investments, and the economic stability afforded by multiple byproducts. Within this framework, and in accordance with IAS 41, agricultural products can be defined in two segments, bios, and agri. Bio products include live assets/plants and animals, i.e., cows, plantations, while agri products are considered to be the fruit or grain harvest that are still lying with the farm/stocks before sell or use [2]. Per IAS 41, bios are measured at fair value less selling costs, which in this case, favors the capital holders when it comes to financial reporting. In this light, the companies that use the historical cost method in accounting are at a loss, since the majority of the banks do not consider biological assets valued at historical cost as collateral for loans [26].

There are complications regarding the measurement and valuation of biological assets especially when the adoption of alternative models is limited. Under such circumstances, a fair

value measurement of the outputs of the asset supports the application of the discounted cash flow valuation method after harvest of the final biological transformation stage, until the date of sale. This method, which is guided by IFRS 13, is based on expected cash flows and excludes ownership costs. This method also assumes that there is certain uniformity of the biological transformation processes across the industry. This method also expands recognition and measurement to the output stages where cash flows are expected to be generated. Both value outcomes, that is, valuation based on expected cash flows from the outputs of the biological asset and the valuation for the discounted cash flows after the ultimate biological transformation, are in compliance with IFRS 13.

Estimating the fair value of biological assets when there are no observable market prices is difficult. Possible approaches are historical cost measurement which, while objective, is less relevant because in this method price and cost expectations are ignored, and fair value estimation by applying different valuation techniques. Of the two, fair value estimation is more in tune with modern accounting principles and the IASB conceptual framework which advocates for fair value measurement if it is feasible. Consequently, applying fair value estimation techniques ultimately best fulfills the purpose of the standards while providing a better value proposition to the users of the information despite the evidentiary challenges. [27]

Market Price Fluctuations

From the beginning, Indonesia emphasized historical cost method of accounting, which is based on transactional pricing. However, historical cost method ignores the changes in value of past transactions, which, can lead to financial statement loss relevance. Financial statements based on historical cost method tend to lose accuracy as time goes by, thus, losing relevance in decision making. Asset values, including when worth is in line with market trends, can be eroded by price volatility in the market. According to the accounting standards, fair value is the price that would be received when selling an asset and, in case of a liability, the price that would be paid to settle the liability. Relating to the valuation of biological assets, the recently released IFRS standards, including IAS 41, require biological assets to be measured and reported at fair value less the cost of selling at the time of acquisition and at the time of reporting. This helps the users of financial statements to appreciate that there has been a significant improvement in the quality of financial reporting. When there is an active market, prices that are determined in that market are the best way of measuring the fair value of biological assets.

The biological transformation of biological assets means that their fair value can fluctuate according to changing market factors. Fair value measurement helps to ensure that farmers do not lose potentially expensive contractual agreements. Where no active market exists, fair value can be estimated based on prices from recent transactions, similar assets priced with adjustments, or industry benchmarks, such as yield per hectare. If we do not know the value then we use the cost model. The cost model is the cost method, minus the accumulated depreciation of the assets. This cost model is what the standards say we should use. It is also what we use for agricultural accounting. Usually the fair value measure is the way to value biological assets [28].

Biological Transformation

The biological conversion starts with purchasing of day old chicks (DOC). The chicks are purchased at their market value depending on how many you purchase. As they grow bigger, their pricing also changes. Of pricing them on the basis of a head, they start getting priced on a per kilogram basis. There is also a change in the valuation method. Live chickens become a part of assets as well as day old chicks (DOC).Profit or loss is caused by changes in fair value from the acquisition date. The presentation and recognition of live birds are in accordance with the Indonesian financial accounting standards. The financial data relevance improves with the implementation of IAS 41 [2].

Case Study Overview

This case study examines how biological assets, particularly dairy cattle, are accounted for within a specific public entity in Iraq's Wasit Governorate. It details how IAS 41 Agriculture has been implemented for different biological assets in this sector. The study employed primary

data obtained through field visits and interviews with relevant personnel who help elucidate the unique accounting policies employed by the public entity. Besides the primary data, the analysis also relied on secondary data obtained by systematically reviewing available financial statements, archives, and documents.

Critical characteristics and important aspects have been identified from the documents that have been gathered through methodological content analysis. This analysis also attempts to understand the extent to which IAS 41 is applied as an accounting standard and its importance and impact in relation to the case of Indonesia for the management of livestock. The study covers preparation of complete financial and management reports, adjustments to the accounts in compliance with IAS 41, fair value assessment of biological assets, recognition of those assets, and critique of the existing practices of disclosure.

The activities that were completed for this study included identifying the relevant standards that guide the recognition, measurement, reporting, and disclosure of biological assets, identifying the various categories of biological assets relevant to the sector, studying the current coverage of agricultural activities, and the operational activities of the public entity in relation to the standards and guidelines of IAS 41, pinpointing the gaps of full compliance of some entities with IAS 41, and the legacy impacts of adopting IAS 41 on the financial statements of the public entity under review. This study aims to address an important gap in the area of financial management of biological assets in agriculture [2], [29], [30].

Methods

The research subject is the accounting treatment of biological assets in the Wasit Governorate. The subject of accounting analysis is an agricultural company that operates within the livestock sector in the Wasit Governorate. The research employs primary data as well as secondary data. Primary data is obtained from observations and interviews conducted with the company staff concerning the accounting treatment of biological assets. Secondary data consists of the financial statements and other documents related to the measurement, recognition, and disclosure of biological assets. Content analysis is used to identify certain attributes or information within the documents. The documents in question include financial statements, management reports, and other related documents, especially those pertaining to biological assets. The purpose of content analysis is to assess how IAS 41 Agriculture is applied in the company. The steps of the analysis include the following.

Data Collection Methods

This chapter outlines the most common techniques used for data collection, both primary and secondary, as well as the methods used to collect data from the case study participants in this research.

Additionally, the primary methods for data analysis are described.

Analysis Techniques

IAS 41 Agriculture provides guidance on accounting for agricultural products that are harvested from an entity's biological assets. Due to biological transformations, biological assets cannot be accounted for using the traditional historical cost model. Instead, entities are to account for biological assets at their fair value less costs to sell at initial recognition and at every reporting date. Any change in the fair value less costs to sell of biological assets is to be recognized in profit or loss. Biological assets for sale are categorized as inventory as per IAS 2 Inventories. There are some limited exceptions to IAS 41, specifically, land associated with biological assets and bearer plants [2], [28]. The methods that are outlined provide guidance for the selection and application of techniques to the accounting issues of biological assets within the framework of IAS 41.

Findings from the Case Study

The findings emphasize the importance of identifying all assets under IAS 41, especially those without scrap value, and also highlight the need for preparing relevant disclosure notes.

Financial Reporting Issues

IAS 41 is the standard for reporting biological assets (live animals and plants, agricultural

produce) in the accounting field. IAS 41 states biological assets must be measured at fair value, less estimated costs at the point of sale (not historical cost), due to the perpetual change in the asset's value due to growth, degeneration, or biological processes. Some farm produce is measured at cost and this exemption is dependent on the type of farm.

The challenges that TJS Farm, located in the Wasit governorate, encounters in relation to IAS 41. It measures day-old chicks at historical costs and live 6-week-old broilers at fair value. There is not full reliability due to the differences in recognition of biological assets, presentation of financial assets, and disclosure of biol.\. employee, knowledge of the IFRS and biological assets, and measurements and reporting of IAS41 standards. Developing this area should result in less financial reporting issues for the farm [2].

Compliance with IAS 41

Of the three livestock farms evaluated, only one achieved a level of compliance with IAS 41. This was due to a lack of sufficient management, IT, and accounting systems. The lack of compliance was also due to the farmers' limited understanding of the fair-value criteria and the associated requirements of IAS 41. With respect to measurement practices, there are essentially three categories: a farm that applies the cost model to all biological assets, a farm that exclusively applies the fair value method, and a farm that uses the cost approach for RNA calves and the fair value approach for adult livestock. Compliance with IAS 41 is dependent on three issues: the understanding of IAS 41, the management and financial information systems, and fair value accounting for biological assets [28], [2].

Stakeholder Perspectives

Of the three livestock farms examined, only one farm achieved compliance with IAS 41, while in the other two, noncompliance was due to insufficient management, IT, and accounting systems. Lack of compliance was also due to farmers' unfamiliarity with the fair-value concept and its applicability within IAS 41. Measurement practices were inconsistent, as one farm relied on the cost model for all of its biological assets, another farm used the fair value method in isolation, while the third farm utilized the cost method for RNA calves and the fair value method for adult livestock. Generally, three elements influence the compliance with IAS 41: understanding the principles of IAS 41, the presence of management and financial information systems, and fair value accounting for biological assets [28], [2].

Discussion of Findings

From a business perspective, the application of the fair value model is quite problematic and complex, resulting mainly from the persistence and absence of active markets with a lack of observable prices, and the appropriate industry pricing bases. This primary and fundamental limitation creates numerous challenges for companies as they try to meet the required criteria that permit a reliable determination of and support for the carrying value of assets and liabilities. The value of the assets and liabilities, and the specific valuation approach, create uncertainty and, therefore, require companies to prepare a detailed fair value policy that takes them through the challenges of assessing fair value. Furthermore, given the challenges and obstacles that can complicate the valuation process, the consistency and persistence of the industry to value and comply with the spirit of fair value accounting is commendable. Companies must address the challenges posed by the fair value model to improve the ease with which value can be assessed. [2], [31], [32], [33].

Implications for Practitioners

IAS 41 states that biological assets should be valued at fair value, less cost to sell. Owing to the shift from historical cost to fair value model, measuring at fair value in accounting for agricultural activities is left unadopted by some companies in Indonesia. TJS Farm, for instance, applies historical cost to biological assets like day old chicks (DOC), while using fair value for live birds. Such differing accounting treatments for identical biological assets lead to IAS 41 non-compliance while TJS Farm's financial statements have issues with reliability [2]. Improvements in the quality of presentation and disclosure under IAS 41, especially in accounting staff's knowledge of IFRS and biological assets, is required. [12], [10], [34]

Recommendations for Improvement

The most important goal of this work was to identify specific accounting problems linked to

the measuring of biological assets under IAS 41. This was done by an internal case study based on the Wasit Governorate. This study attempted to determine and explain the existing gaps between the current reporting practices in Wasit and those prescribed by IAS 41. Additionally, this study focused on the gaps in the implementation of IAS 41 and the effect of IAS 41 on the financial accounting practices of the agricultural entities in the region. This study attempted to improve the accounting of biological assets.

Because of the many findings in the study, the following recommendations are proposed.

1) There should be more urgency by the Ministry of Municipalities to provide the agricultural activities provisions of IAS 41 so that agrarian entities can define their accounting activities within the provisions of the IAS.

2) There should be more concrete action by the Ministry to implement the provisions of IAS 41 in the accounting practices of agrarian production activities, especially to ensure that the practices in accounting are in alignment to the recognition and measurement prescribed by the standard practices.

3) Entities should create and preserve extensive, precise, and thoroughly cataloged records of biological assets and agricultural activity from the start of these operations. Such records should include the information required to enable an evaluation of compliance with IAS 41, and improve the quality of the associated financial reporting on biological assets [2], [28].

Comparative Analysis with Other Regions

There are many differing estimated adoptions of IAS 41 Agriculture within accounting standards relating to agriculture for ASEAN Member-States. Most of these countries have started modifying their accounting standards to accommodate International Accounting Standards (IAS). The Philippines &Thailand and the Member States of the Association of Southeast Asian Nations (ASEAN) have essentially adopted IAS as the basis for their accounting standards. Malaysia is currently revising its accounting standards to reflect the latest IAS, while Vietnam is expected to make complex changes to its standards. Indonesia's project called PSI 18 draft standard for accounting the agriculture (14.2) is essentially IAS 41

In Ethiopia, the draft standard for the accounting of the agricultural area is standard in the USA. Most agricultural businesses use this standard. The accounting approach of the USA in the agricultural sector is pendulum, meaning that it solely records all agricultural assets of any nature and in any form and of any price using the cost method. The Ethiopian government is expediting the element that does mandatorily accounting for commercial farming businesses, as a result of deficiency in the developed in the accounting cooperative system. Some mid-level cooperatives have adopted IFR, Cost hectare othe otherUSAed by the of the} else). Therefore, the cost method is widely practiced. The above justifications demonstrate that Ethiopia is not prepared to accept all of IAS FORS on agriculture. Adopting the standards will require a complete transformation in Ethiopia.

Regulatory Framework

The International Accounting Standards Board (IASB) enacted the International Accounting Standards (IAS) 41, Agriculture, on 30 March 2000, superseding older standards, interpretations, and guidance notes. IAS 41 considers the living plants and animals of an entity as biological assets, and the entity's harvested product from its biological assets as agricultural produce.

The scope of IAS 41 covers entities engaging in agricultural activity, the management of the biological transformation of biological assets for sale, into agricultural produce, or into additional biological assets. Some of the exemptions to the standard include recognition and measurement of minerals, mineral products and land; recognition only of agro-related government grants and government investment property, and the classification and measurement of bearer plants, which are accounted for at cost in accordance with IAS 16, Property, Plant and Equipment.

IAS 41 also defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an ordinary transaction between market participants at the measurement date. The standard states that biological assets must be measured at fair value less costs to sell at initial recognition and at the end of each reporting period, unless fair value cannot be

measured reliably. Agricultural produce harvests should be measured at fair value less costs to sell at harvest (i.e. at the point of biological transformation into a non-biological asset).

International Standards Overview

International Accounting Standards (IAS) stipulate that biological assets for an entity should be transferred to the fair value of the assets when an asset has the ability to generate income in future. Within IAS 41, an exposure draft is scoped to the Agriculture business; an agricultural product, is the harvested plant, the harvest for the desired Agriculture is tradable. The exposure draft creates situations that arise from the destruction of assets that are produced biologically or physically that should not be covered under IAS 41. Biological assets mean the harvest of the plant and the slaughtering of the livestock in the primary agriculture. Even when there is a biological transformation, in the case of the non-agricultural, there is the destruction. In the case of property, plant, and equipment, the destruction is caused by fire or heat; in these situations, these assets do not fall within the ambit of IAS 41 but rather IAS 16, to be more precise, [28]. Agriculture is the management of biological transformation of living plant or animal, and in this case, one has to draw the line at any non-biological transformation that does not fall under IAS 41. The requirement springs from the reconfirmation of agricultural assets only to the situation when the asset is no longer covered by IAS 16, property, plant, and equipment or any other standard; a new set of standards has provisions relating to biological transformations that are not purely agricultural.

Moreover, IAS 41 includes such extensive restrictions on the exposures of government-controlled public assets that there is no expected residual interest to the private sector or qualified benefit from such ownership or control of the assets [27].

Local Regulations in Iraq

Biological assets have not received specific legislative recognition in Iraq's general accounting principles, as these have not been updated since the accounting law of 1979. Under the current Iraqi legal system, the practitioner can choose one of three institutions to apply standards. An isolated case is when someone follows international standards, while the other option is to follow the International Accounting Standards Committee (IASC). However, because there is no audit association, these opportunities for public limited companies become non-existent, leaving businesses in a legislative vacuum. Although Iraq is predominantly Islamic, it has not implemented Islamic Financial Accounting Standards.

Future Trends in Accounting for Biological Assets

Future direction patterns related to Agriculture accounting show the increasing impact of agricultural-related activities to the developing economies, thus the need to capture such activities. Changes to the International Accounting Standards (IAS) based on the International Financial Reporting Standards (IFRS) and the Conceptual Framework must happen regularly as the current accounting practices reporting on agricultural activities seems to not report the overall financial value of the transactions. There are difficulties in reporting value of agricultural activities related to reporting of the activities in the appropriate accounting period based on the production and biological growth.

Due to the logistics and dynamic nature of agriculture, the reporting of value of agricultural products is affected by location and time. Another way is to look at the process of production over a particular average period, reviewing all assets (both rural and urban) and separating all aspects of the crop and livestock agricultural production process.

Future attempts in agriculture accounting need to capture and report value of International Accounting Standards (IAS) to bridge the gap between the conceptual framework and general purpose financial reporting. Modifications and adaptations to the reporting standards of the International Financial Reporting Standards (IFRS) will help to improve them.

The objective of this research is to assess the problems of Hayati farmers in the Wasit Governorate regarding the livestock measuring case in the framework of IAS 41 standard. The research utilizes the descriptive analytical method, which is complemented by a qualitative approach, regarding the implementation of IAS 41 in a live context. The IAS 41 agriculture standard offers a consistent, uniform, and standard accounting treatment to a wide scope of biological assets, irrespective of the agricultural activity at hand and how the biological asset

is being utilized in the business [28].

The world's various countries have standards which may include partial applicability. The standards may conflict with government regulations which require varying or additional accounting treatments. In this situation, compliance with government regulations takes precedence over IAS 41 [2]. While the accounting framework doesn't specifically instruct, the framework clearly supports the accounting policy that best reflects the underlying economics. In regard to revenue recognition, the measurement basis of the asset raises no issue, and so the asset may be sold freely without restriction. However, biological assets are unique in that unlike other assets, they transform continuously while the owner has no legal title. IAS 41 has the unique requirement that assets in production be measured at fair value less costs to sell, regardless of the owner's ability to sell the asset on the measurement. Agricultural activities are constantly evolving, so the measurement requirement on biological assets at fair value less costs to sell ensures that each phase of the agricultural production cycle is reflected in the financial statement.

Results and Discussion

Results

Empirical Results and Hypothesis Testing

This section presents the empirical results of the quantitative analysis of biological-asset fair-value data collected from the case-study entity in Wasit Governorate (N = 50 valuation cases across five biological asset categories: Cattle & Livestock, Sheep & Goats, Poultry, Palm Trees, and Vineyards). Consistent with the pre-specified statistical analysis plan, the analysis proceeds in four stages: (1) descriptive statistics and normality diagnostics for the study variables; (2) group comparisons of fair-value metrics across biological asset categories using the Kruskal-Wallis test as the primary (non-parametric) method, with Welch's ANOVA reported as a sensitivity check; (3) correlation analysis between the fair-value metrics; and (4) a chi-square test of association between asset category and revaluation direction (gain vs. loss). Every table is complemented by a number. All the numbers are included regardless of whether they are statistically significant or not. Some numbers are merely the result of our way of accounting and not findings. They are marked in the results section as such so that there are no misunderstandings. They are not excluded; they are just marked properly.

Descriptive Statistics of the Study Variables

Table 1 reports descriptive statistics for the five fair-value metrics derived for each valuation case: Beginning Fair Value, Change in Fair Value, Ending Fair Value, Absolute Change |ΔFV|, and Percentage Change in Fair Value.

Table 1. Descriptive Statistics of Study Variables (N = 50)

Variable	Unit	N	Mean	Std Dev	Min	Max	Median	Skewness	Kurtosis	CV (%)
Beginning Fair Value	IQD	50	4,829,000	2,218,684.34	1,450,000	8,700,000	5,150,000	-0.032	-1.047	45.9
Change in Fair Value	IQD	50	205,800	192,810.47	-300,000	550,000	235,000	-0.526	0.077	93.7
Ending Fair Value	IQD	50	5,034,800	2,346,574.79	1,550,000	9,200,000	5,375,000	0.018	-1.030	46.6
Absolute Change |ΔFV|	IQD	50	249,000	130,872.27	80,000	550,000	250,000	0.620	-0.529	52.6
Percentage Change in FV	%	50	4.08	3.57	-5.88	8.12	5.26	-1.752	1.845	87.4

Shapiro-Wilk tests were used to assess univariate normality for each variable prior to test selection (Table 2). Four of the five pooled-sample variables depart significantly from normality ($P < 0.05$), which reflects the multi-modal character of the pooled sample — asset categories differ greatly in scale — rather than a data-quality problem. Non-parametric methods (Kruskal-

Wallis, Spearman) are therefore used as the primary inferential approach for the pooled sample, with parametric methods (Welch ANOVA, Pearson) reported alongside as a sensitivity analysis.

Table 2. Normality Tests (Shapiro-Wilk, α = 0.05)

Variable	S-W Statistic (W)	P-value	Result	Recommended Test
Beginning Fair Value	0.9395	0.0128	Non-normal (P<0.05)	Non-parametric (Kruskal-Wallis / Spearman)
Change in Fair Value	0.9570	0.0666	Normal (P>0.05)	Parametric (t-test / Pearson / ANOVA)
Ending Fair Value	0.9397	0.0131	Non-normal (P<0.05)	Non-parametric (Kruskal-Wallis / Spearman)
Absolute Change |ΔFV|	0.9230	0.0030	Non-normal (P<0.05)	Non-parametric (Kruskal-Wallis / Spearman)
Percentage Change in FV	0.7151	<0.001	Non-normal (P<0.05)	Non-parametric (Kruskal-Wallis / Spearman)

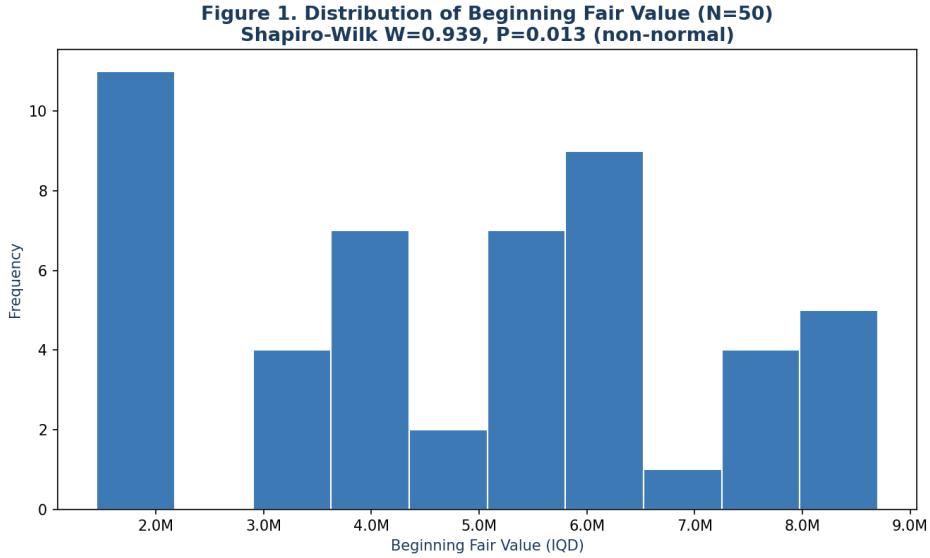

Figure 1. Distribution of Beginning Fair Value (N = 50). The histogram illustrates the multi-modal shape underlying the significant Shapiro-Wilk result, reflecting the pooling of structurally different asset categories.

Group Comparison of Fair-Value Metrics Across Biological Asset Categories

This part will look at RQ1, RQ2 and RQ3. These questions are about whether Beginning Fair Value, Change in Fair Value and the amount of revaluation (|ΔFV|)'re different, for the five biological assets. The Kruskal-Wallis H test was used for the test. The Welchs ANOVA was used as a test when the variances are not equal. Levene's test of variance equality was used to decide if Welchs ANOVA should be used of ANOVA.

Table 3. Group Comparison of Fair-Value Metrics Across Biological Asset Categories

Variable	KW H	df	KW P-value	ε² (effect size)	Welch F	Welch df	Welch P-value	Partial η²
Beginning Fair Value	45.34	4	<0.001	0.919	1050.62	4, 20.2	<0.001	0.958
Change in Fair Value	29.71	4	<0.001	0.571	16.75	4, 22.3	<0.001	0.410
Ending Fair Value	45.53	4	<0.001	0.923	995.04	4, 20.6	<0.001	0.953

Journal of Kyzylorda Scholarly Review
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Variable	KW H	df	KW P-value	ε² (effect size)	Welch F	Welch df	Welch P-value	Partial η²
Absolute Change	41.81	4	<0.001	0.840	101.00	4, 17.6	<0.001	0.861
% Change	8.56	4	0.073	0.101	0.70	4, 21.6	0.602	0.053

ε² (epsilon-squared) effect size for Kruskal-Wallis: ≈0.01 small, ≈0.06 medium, ≈0.14 large (Tomczak & Tomczak convention, adapted). Partial η² for Welch ANOVA follows the Cohen (1988) convention. Primary test: Kruskal-Wallis H (non-parametric); sensitivity test: Welch's ANOVA (robust to unequal variances).

Table 4. Levene's Test for Homogeneity of Variances

Variable	Levene Statistic	P-value	Variances Equal?
Beginning Fair Value	4.744	0.0028	No (P<0.05) → Welch ANOVA preferred
Change in Fair Value	0.809	0.5261	Yes (P>0.05) → classic ANOVA assumption satisfied
Ending Fair Value	4.809	0.0026	No (P<0.05) → Welch ANOVA preferred

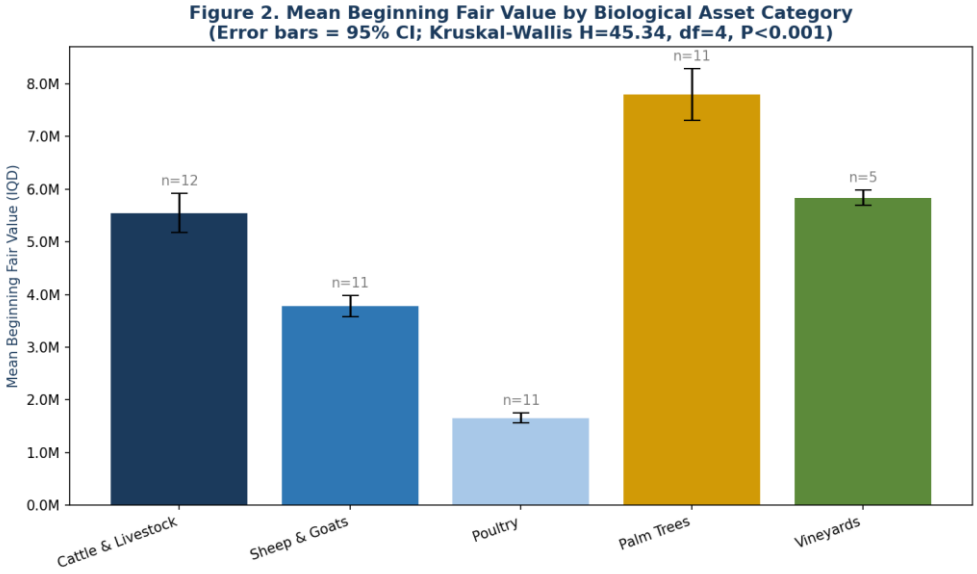

Figure 2. Mean Beginning Fair Value by biological asset category, with 95% confidence intervals. Palm Trees show the highest mean beginning fair value and Poultry the lowest, consistent with the very large effect size (ε² = 0.92).

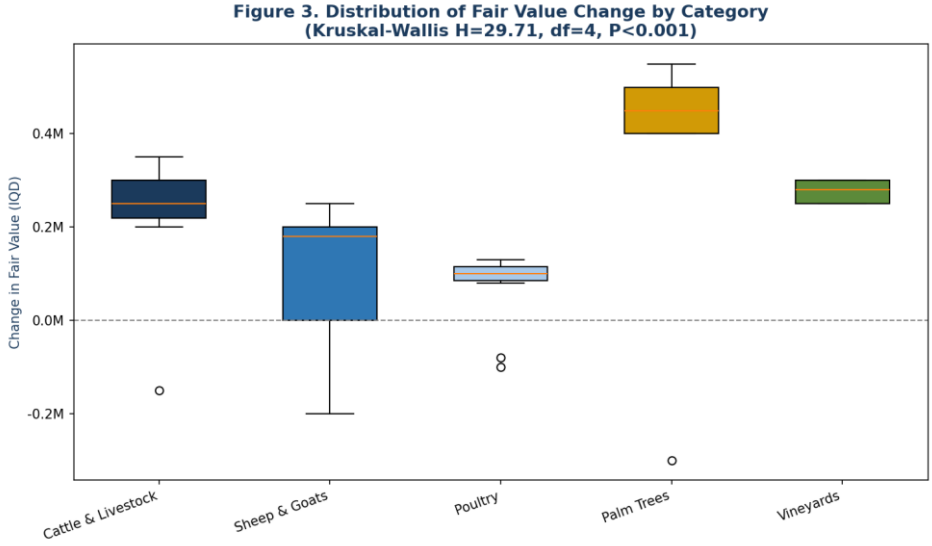

Figure 3. Distribution of Change in Fair Value by category. Palm Trees show the largest median gain; the boxplot also reveals the small number of loss cases (points below the zero line) in several categories.

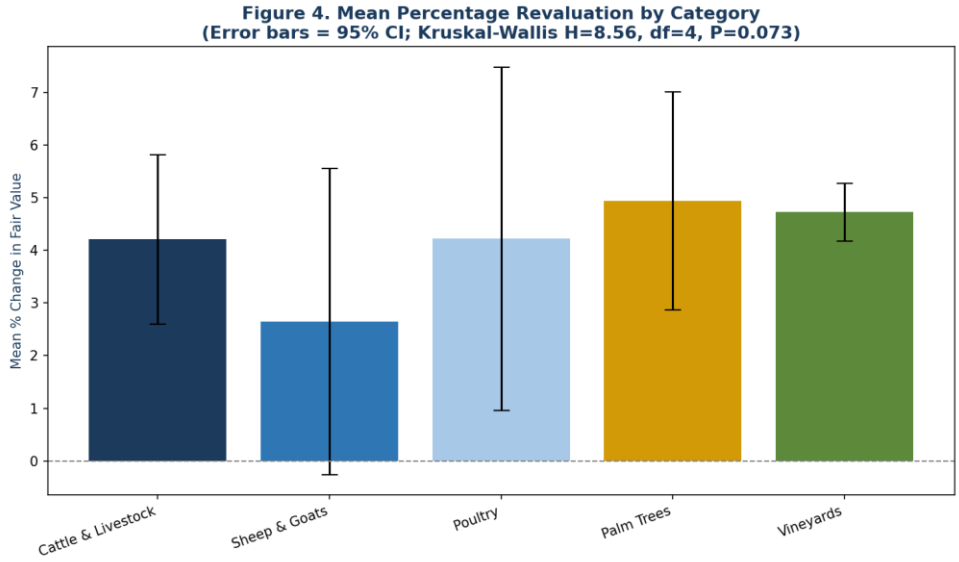

Figure 4. Mean percentage revaluation by category, with 95% confidence intervals. Unlike the absolute fair-value metrics, the percentage change does not differ significantly across categories (P = 0.073), suggesting that revaluation is broadly proportional to asset size.

Since the Kruskal-Wallis omnibus test was found to be statistically significant (P < 0.05) for Beginning Fair Value, for Change in Fair Value, for Ending Fair Value and for Absolute Change, Dunns post-hoc test with Bonferroni correction was employed in order to determine which pairs of categories differ. The adjusted P-values for Beginning Fair Value and for all other three variables are presented in Table 5. Poultry differs significantly from Palm Trees and from Cattle & Livestock in regard to Beginning Fair Value, Poultry differs significantly from Palm Trees and from Cattle & Livestock in regard to Change in Fair Value, Poultry differs significantly from Palm Trees and from Cattle & Livestock in regard to Ending Fair Value, Poultry differs significantly from Palm Trees and from Cattle & Livestock in regard to Absolute Change. The other two categories of scale (Cattle & Livestock vs. Vineyards) do not differ significantly in all four variables.

Table 5a. Post-Hoc Pairwise Comparisons (Dunn's Test, Bonferroni-adjusted P-values) — Beginning Fair Value

	Cattle & Livestock	**Sheep & Goats**	**Poultry**	**Palm Trees**	**Vineyards**
Cattle & Livestock	—	0.2791	**0.0006**	0.1795	1
Sheep & Goats	0.2791	—	0.7672	**0.0001**	0.4181
Poultry	**0.0006**	0.7672	—	**0**	**0.0059**
Palm Trees	0.1795	**0.0001**	**0**	—	1
Vineyards	1	0.4181	**0.0059**	1	—

Shaded/bold cells: adjusted P<0.05 (statistically significant pairwise difference).

Cells marked green and bold are significant, and this is after making some correction on the work in order to ensure that no type I error was committed. This has been done for all variables investigated. Each group has been compared with all other groups. Some significant differences were found among some groups for Beginning Fair Value. For instance, the difference between Cattle & Livestock and Poultry, the difference between Sheep & Goats and

Palm Trees, the difference between Poultry and Palm Trees and lastly the difference between Poultry and Vineyards. We also investigated the Change in Fair Value, Ending Fair Value and Absolute Change. Results for all these investigations are similar to Beginning Fair Value results. We have summarized all these in a workbook but will not show all of them here because this book will become very long. We will discuss the results in the remaining part of the book.

Correlation Analysis between Fair-Value Metrics

This section will focus on the correlation between Beginning Fair Value and the Change in Value. The interest lies in identifying the correlation between the variable of interest and the change as well as relative change in fair value. Beginning Fair Value is the dependent variable. Pearson's r is used as the measure of the relationship between the variables in view of the linearity between Beginning Fair Value and the change in value. The Beginning Fair Value is the dependent variable. Spearman's ρ is used in order to confirm the results in case there is any doubt.

Table 6. Correlation Analysis between Fair-Value Metrics

Variable A	Variable B	N	Pearson r	95% CI (r)	P-value	Spearman ρ	P-value
Beginning FV	Change in FV	50	0.639	[0.439, 0.779]	<0.001	0.771	<0.001
Beginning FV	Ending FV *	50	0.998	[0.996, 0.999]	<0.001	0.996	<0.001
Beginning FV	|Change in FV|	50	0.905	[0.838, 0.945]	<0.001	0.899	<0.001
Change in FV	Ending FV *	50	0.686	[0.504, 0.810]	<0.001	0.795	<0.001
Beginning FV	% Change in FV	50	0.112	[-0.172, 0.379]	0.439	-0.063	0.664

* Beginning FV ↔ Ending FV and Change FV ↔ Ending FV are structural accounting identities (Ending FV = Beginning FV + Change) rather than independent empirical findings; the near-perfect correlation is mechanical and is reported for completeness only, not interpreted substantively. The Beginning FV × % Change association is not statistically significant (P = 0.439), indicating that the relative (percentage) revaluation is independent of asset size — small and large assets are revalued by similar proportions.

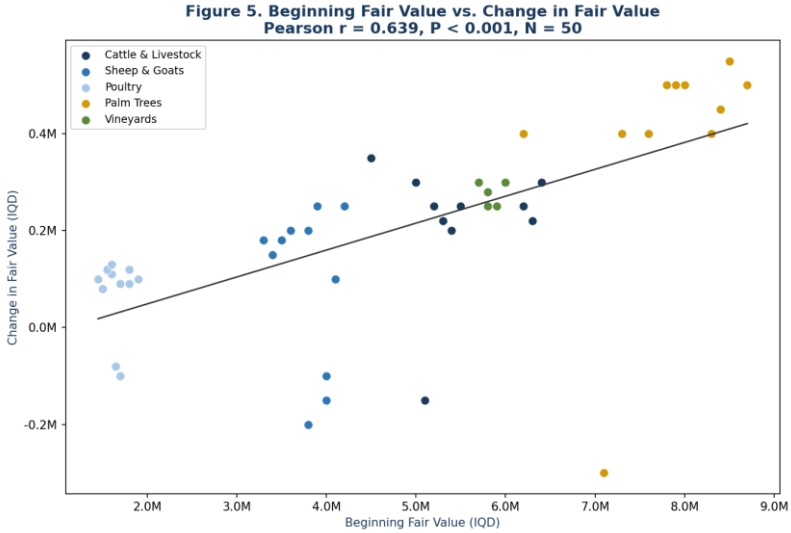

Figure 5. Beginning Fair Value vs. Change in Fair Value, by asset category (Pearson r = 0.639, P<0.001, N=50). Larger-value assets tend to show larger absolute fair-value gains.

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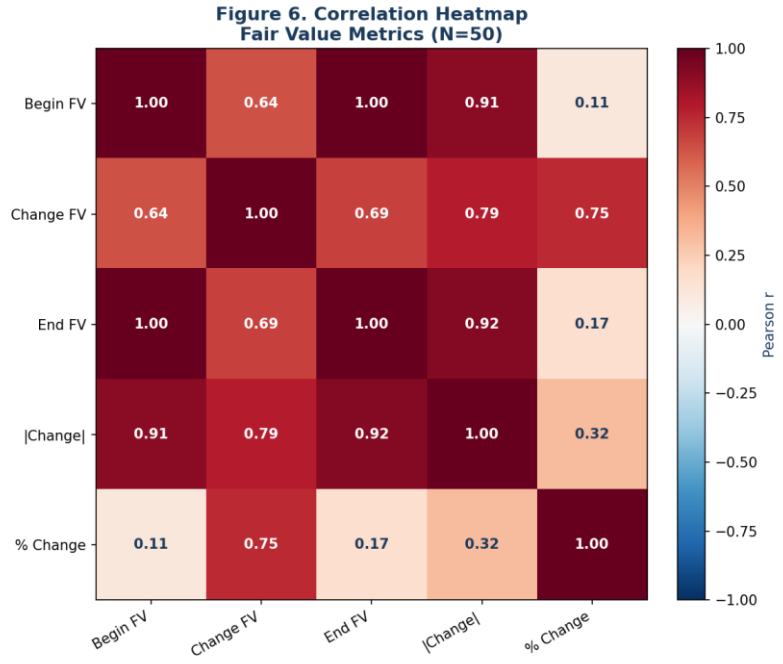

Figure 6. Correlation heatmap summarizing the full Pearson correlation matrix across all five fair-value metrics (N=50). The near-1.00 cells for Beginning/Ending FV reflect the structural accounting identity noted in Table 6.

Association Between Asset Category and Revaluation Direction

This subsection addresses RQ6–RQ7: whether revaluation direction (gain vs. loss) is associated with biological asset category, and whether the overall gain rate differs from a 50/50 baseline. A 5×2 Pearson chi-square test of independence was used for the first question and an exact binomial test for the second.

Table 7. Contingency Table: Revaluation Direction by Asset Category

Asset Category	Gain, n (%)	Loss, n (%)	Row Total
Cattle & Livestock	11 (91.7%)	1 (8.3%)	12
Sheep & Goats	8 (72.7%)	3 (27.3%)	11
Poultry	9 (81.8%)	2 (18.2%)	11
Palm Trees	10 (90.9%)	1 (9.1%)	11
Vineyards	5 (100.0%)	0 (0.0%)	5
Total	43 (86.0%)	7 (14.0%)	50

Table 8. Chi-Square Test Statistics

Statistic	Value
Pearson Chi-square (χ^2)	3.123
Degrees of freedom	4
P-value	0.537
Cramér's V (effect size)	0.25
Minimum expected cell frequency	0.7
Cells with expected count < 5	60% of cells

Assumption violation flag: 60% of cells have an expected frequency below 5, exceeding Cochran's rule-of-thumb threshold (<20%). The chi-square approximation is therefore unreliable for this table, and the result (χ^2=3.12, P=0.537) should be treated as exploratory/descriptive only, not as confirmatory evidence of independence. A Fisher-Freeman-Halton exact test would be the statistically correct alternative for a 5×2 table with sparse cells, but was not computed here as it requires specialized software beyond what could be verified in this environment; Cramér's V = 0.25 suggests a small-to-moderate association if a valid test

were available, but this must not be over-interpreted given the assumption violation.

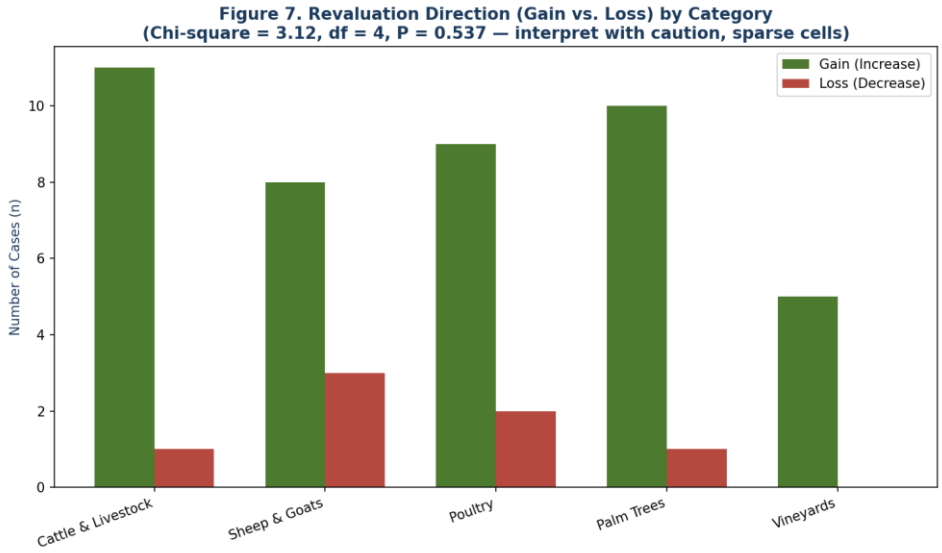

Figure 7. Revaluation direction (gain vs. loss) by biological asset category. The chi-square association across categories is not statistically reliable given sparse expected cell counts (see Table 8) and should be read as exploratory only.

Table 9. Supplementary Test: Exact Binomial Test of Overall Gain Rate vs. 50%

Statistic	Value
Observed gains	43 of 50 cases
Observed proportion	86.0%
95% CI (Clopper-Pearson)	[73.3%, 94.2%]
Null hypothesis	P(Gain) = 0.50
P-value (exact binomial, two-sided)	<0.001
Verdict	Reject H0 — gains significantly outnumber losses

Overall, 86.0% of the 50 valuation cases recorded a fair-value gain, significantly above the 50% chance baseline (exact binomial P<0.001). This confirms that fair-value gains substantially outnumber losses in the sample as a whole, even though the distribution of gains and losses does not differ reliably across asset categories.

Summary of Relationships

Table 10 consolidates every relationship examined in this section into a single master matrix, cross-referencing the predictor, outcome, statistical method, estimate, and interpretation for each analysis.

Table 10. Master Relationship Matrix

Predictor	Outcome	Method	Estimate	P-value	Effect Size	Interpretation
Asset Category	Beginning FV	Kruskal-Wallis / Welch ANOVA	H=45.34 / F=1050.6	<0.001	ε^2=0.92	Very large, robust difference across categories (scale-driven).
Asset Category	Change in FV	Kruskal-Wallis / Welch ANOVA	H=29.71 / F=16.75	<0.001	ε^2=0.57	Large difference in absolute gain/loss across categories.
Asset Category	Ending FV	Kruskal-Wallis / Welch ANOVA	H=45.53 / F=995.0	<0.001	ε^2=0.92	Mirrors Beginning FV (structurally linked).

Asset Category	|ΔFV|	Kruskal-Wallis	H=41.81	<0.001	ε²=0.84	Magnitude of revaluation differs strongly by category.
Asset Category	% Change in FV	Kruskal-Wallis	H=8.56	0.073	ε²=0.10	No significant evidence of a difference in relative revaluation rate.
Beginning FV	Change in FV	Pearson / Spearman	r=0.639	<0.001	large	Larger-value assets show larger absolute gains.
Beginning FV	Ending FV	Pearson / Spearman	r=0.998	<0.001	structural	Structural identity, not an independent finding.
Beginning FV	|ΔFV|	Pearson / Spearman	r=0.905	<0.001	very large	Revaluation magnitude scales with asset size.
Beginning FV	% Change in FV	Pearson / Spearman	r=0.112	0.439	negligible	No evidence relative revaluation depends on asset size.
Asset Category	Revaluation Direction	Pearson Chi-square	χ^2=3.12	0.537	Cramér's V=0.25	Unreliable — 60% of cells have expected count <5.
(pooled sample)	Revaluation Direction	Exact Binomial	86.0% Gain	<0.001	—	Gains significantly outnumber losses (43 of 50).

Discussion

In the first regression analysis result table, it can be seen that four main variables are the determinants of assets: growth, biological transformation, market value, and production capacity. They impact the financial performance of agriculture industry in Wasit governorate based on IAS 41 regulations. Unlike other accounting standards, IAS 41 concentrates more on the economic basis of the standard rather than its compliance as there is no market in cases when biological assets are meant to generate income.

Analyzing the results of the current study it is possible to see the contradiction between theoretical background and its practical implementation. According to some researchers, it is possible to use a value-based approach to make accounting information about biological assets more relevant and valuable as it reflects the actual economic situation of such assets. It is claimed that the value-based approach will help management in decision-making and in providing more transparent financial reports to investors. But the implementation of this approach is difficult in cases when there is no active market and data is not reliable. In such situations, it is impossible to estimate the price of assets and accounting information will become vague. [35]

It becomes even more complex due to the fact that there are no sufficient regulations to facilitate proper functioning of the agricultural sector in Wasit Governorate. Iraqi companies show low levels of compliance with accounting regulations. Thus, the problem with the agricultural sector in Wasit Governorate is structural, and not motivational. Financial statements are needed from the agricultural sector in Wasit, however, getting them is quite problematic. It is the second model that caught our eye and deserves special attention. The results of the study have shown that this model is much more complicated that was assumed at first glance. For example, the obtained data show this complication even in cases when the evidence is not very strong. It does not mean that there is no correlation between the changes in the value and the performance of the agricultural these problems are not exclusive to Wasit's sector; similar problems appear elsewhere as well. Researching this topic, scientists have noticed some practical problems of using IAS 41. These problems include high level of volatility,

problems in the estimation of fair value, and problems in the collection of reliable information. Moreover, there is a need for an accounting system which will be able to handle various cultural, climatic and productivity conditions in every agricultural area. Such accounting system is necessary for the agricultural sector in Wasit Governorate as well. [36].

The case that exists in Wasit Governorate reflects the larger problem of the "valuation gap" faced by many developing countries. The existence of valuation gap depends on the assumption of existing markets, working prices, and a healthy local economy. In the areas where these assumptions are not fulfilled, there will be deficiencies in the Agricultural Price Information Infrastructure. If there is no market for a particular biological asset, the standard allows an alternative form of valuation. This requires market knowledge, biological know-how, and judgement. As a result, the valuation is not very accurate. This is the valuation problem that has been outlined in Pinnvalor 9.3. The circumstances prevailing on the farms under observation mirror the trends found in many other countries. Practically speaking, the same firm uses both cost and fair value forms of asset valuation. Young dairy calves, for instance, are valued using cost method while adult cows are valued using fair value approach. In this regard, the situation corresponds to those reported in similar cases. Presently existing standards of public accounting have demonstrated their unsuitability in relation to the agricultural industry and caused some problems and relatively high costs. As a result, changes in legislation are needed, but it does not belong to the most common topic of discussion among scholars. Without any changes, accountants have no choice between using the value in an excessively simplified way, which makes financial reports inaccurate and working with cost measurements, which makes financial statements less relevant with time. None of the options can be considered as appropriate for stakeholders, making farmers and investors uncertain about the whole process.

This research does not challenge the framework of IAS 41 theoretically, but calls for a reconsideration of it in the case of developing countries as required by the standard itself. Indeed, this standard was developed for use in markets where professional infrastructure is strong. In case if such a condition is not present in the market, the implementation of the standard should be done carefully and cautiously. There is quite much evidence about the need for a flexible accounting system which would take into consideration the local culture, weather conditions and agricultural specifics. Therefore, there should be cooperation between international accounting associations and local bodies through models of using several approaches to rule-making.

This duplication is not a mistake in the way we do things but it also shows that there is a bigger problem. Everyone knows that the main goal of using the IAS 41 standard is to see if it can help make accounting information because the old way of doing things based on how much things cost in the past did not show the good things that the company would get in the future and that made the information not very good.. If we quickly switch to fair value and we do not have a good way to figure out what things are worth then we will get information that we cannot trust. Studies by Redalyc in places in Colombia show that using fair value and present value to measure things makes the company worth more which is what agency theory says will happen when managers have good options for measuring and sharing information [37]. However this will not work if the Iraqi accounting environment does not have the rules and market conditions. The laws in Iraq make things more complicated. The Iraqi accounting law from 1979 has not been. Made better which creates a situation where agricultural businesses have to deal with different and inconsistent practices. When international accounting standards are not required and there is no system to make sure people follow the rules it is up to each person to decide whether or not to follow them. For the Wasit governorate the important thing to do is to make sure we have the following things: a clear and trustworthy database of agricultural prices that has good ways to figure out what things are worth accountants who are professionals and know about IFRS 13 and laws that are updated and make sense for the current situation and require people to follow them. When we have these three things the good results from the model can actually happen in real life not just in theory. The IAS 41 standard and the IFRS 13 standard are important for the accounting information

to be reliable and the Iraqi accounting environment needs to be improved to make use of these standards. The agricultural businesses, in the Wasit governorate need to have a system to follow the IAS 41 standard and the IFRS 13 standard and this can be done by having a transparent agricultural price database and professional accountants. The Iraqi legislative context needs to be updated to require the use of accounting standards and to make sure that people follow the rules.

Conclusion

Living assets, such as plants and animals, are a separate subcategory of agricultural activities. As per International Accounting Standard, as of October 2023, IAS 41, the measurement of these assets at fair value poses a challenge to agricultural enterprises. It is even more of a challenge for agricultural enterprises to determine the fair value of these assets and what measurement approach to take, as discussed in enduring academic literature [2].

1. First and foremost, the competitive advantage of the fair value accounting standard IAS 41 is of greater relevance to agricultural enterprises in the fair value of their biological assets that is attributable to their growth in value, rather for the historical cost, than providing an irrelevant value that does not benefit them to an even greater degree.
2. The direct financial impact is one for which the statistically fair value adjustment is positive and impacts the significant loss or profit that the agricultural enterprises are reporting.
3. The institutional and regulatory gap is primarily related to the reliance on the general accounting law of 1979, where the local practice in Iraq is not consistent with the international accounting standards.
4. In terms of the measurement of the biological assets, the observable market price of the assets is the missing link, and in the absence of observable market price, the measurement in the absence of complex valuation techniques is far more consistent with the measurement of the assets that are subject to the professional judgment.

Recommendations

1. As for Regulatory Alignment: A legislative framework for agricultural entities in Iraq is sought. This has to come with an IBAAS local standard for Biological Assets that is fully aligned with IAS 41.
2. Concerning Professional Development: The accounting bodies have to institute training requirements for practitioners and auditors for the agricultural sector, specifically regarding IFRS 13 (Fair Value Measurement) as it applies to the sector.
3. As for the Improvement of Market Infrastructure: For the purpose of providing reliable price benchmarks for fair value estimations, it is imperative that the relevant government agencies create transparent databases regarding the agricultural market.
4. The Requirement for Separated Disclosures: Entities are required to improve the reliability of financial information on fair value measurements through detailed qualitative and quantitative disclosures regarding the assumptions that constitute the fair value.
5. Audit Rigor: There has to be an adoption of international best practices, in that, external auditors need to do more when it comes to management biological asset valuation compliance through more detailed procedures to verify the input and models used.

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