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A COMPARISON OF THE INTANGIBLE ASSET RELATED STANDARDS, IAS38, IVS210 AND ISA620 USING SIMILARITY ANALYSIS

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Abstract: This article attempts to describe the standards dealing with intangible asset treatment by multiple regulatory bodies and subsequently compare them using content and similarity analysis. The specific standards debated are IAS 38 from an accounting perspective, IVS 210 from a valuation perspective, and ISA 620 from an auditing perspective. The similarity analysis is conducted using two tools. First, Voyant tools are used to perform a text similarity analysis of the standards' text bodies in portable document format. The technique employed is principal component analysis. The second tool is SPSS version 25, which employs various similarity and dissimilarity measures such as simple matching, Jaccard, and Euclidean coefficient, indicating that the similarity of the standards is rather mediocre in relative terms.

JEL classification: *O30, M40, M48*

Keywords*:* intangibles, assets, standards, regulation, similarity

1. Introduction

Based on current literature, some researchers (Lev., 2008) support development cost capitalisation, while others like Penman, (2009) consider the uncertainty of realizing future economic benefits from R&D a reason to rely more on the combination of income statements and disclosures. It is essential to present the currently implemented professional standards, used to report and evaluate internally generated assets in order to identify the advantages and disadvantages of the existing regulatory framework and the degree of their convergence.

Gong and Wang, (2016) conducted a research to measure the changes in value relevance of research and development expenses after IFRS adoption. They discovered that institutional factors play a significant role in the value relevance changes during the transition from national GAAP to IFRS. Aboody and Lev, (1998) support that development cost capitalisation of software is more informative to investors and that US GAAP should extend capitalisation to other intangibles. They

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identify though that capitalisation is pushed back by financial analysts mainly because it causes them to create erroneous forecasts, thus making their work more complicated. This view that capitalisation complicates the forecasting process is also supported by Dinh et al., (2015b).

The core research question is: Are the provisions of the standards in the matter sufficient to ensure R&D accountability and SH protection? Based on the associated literature there is no definitive answer, mainly due to the uncertainty related to R&D projects (Barker and Penman, 2020). There are valid arguments in favour and against the current standards, although the mission of any standard is the net positive result and not an absolutely efficient framework, which would seem rather unrealistic. Ciftci and Zhou, (2016) present the contradicting views regarding capitalisation and subsequently the importance of intellectual property protection legislation in relevance to disclosures of R&D projects.

The standards regulating intangible assets are IAS 38 for accounting, IVS 210 for evaluation and there is no specific audit focused intangible asset standard with the exception of the ISA 620 which mentions the option of assistance by an auditor's expert in the case of "the valuation of complex financial instruments, land and buildings, plant and machinery, jewellery, works of art, antiques, intangible assets, assets acquired and liabilities assumed in business combinations and assets that may have been impaired" (IAASB, 2021). Invoking an expert has two major drawbacks, the first one is the extra audit cost generated by the additional friction. Cheng et al. (2016) found that development cost capitalisation results in increased audit costs in China due to the high risk and additional work required, especially from industry experts who are nonetheless expensive by definition. Kuo and Lee (2017), conducted a similar research across 21 countries and once again found evidence that development cost capitalisation increases audit costs due to the elevated possibility of earnings management. Additionally, they found that the robustness of the legal framework pertaining to investor protection has an adverse effect on audit costs. However, they do not identify if this legal framework includes intellectual property rights protection. The protection of intellectual property rights is in fact as important for intangibles, as the right of ownership for tangible assets. The obvious disadvantage of intangible assets is the relative easiness with which they can be duplicated or in some cases reverse engineered, causing significant loss of value for the inventors involved with development. This leads to the second drawback which is intensely insinuated by Kuo and Lee (2017); the confidentiality required in an audit of internally generated intangible assets can only be safeguarded by non-disclosure agreements that any auditor or his expert would be reluctant to sign and the audited entity would be wary of its enforcement if it was based in a jurisdiction with loose intellectual property rights legal framework.

Tuttici et al. (2007) investigated the effect of the auditors' size and reputation along with the securities commission's enhanced monitoring on the reliability of development cost capitalisation conducted by public entities in Australia. Their results seem to indicate that the auditors' quality and the securities commission's vigilance motivate management to use development capitalisation more prudently than in cases where the auditor is not among the big five or the securities commission is lightly involved. They also find that, younger R&D intensive firms with high leverage levels, which used to promote high growth, capitalised more often. The industry sector also plays a significant role in the capitalisation decision.

The paper's main pillars will consist of a professional standards' presentation describing their content and a subsequent similarity analysis combined with content analysis. Content analysis will be the first step in identifying the necessary variables to be used in the similarity analysis. Descriptive content analysis seems to be the most appropriate for the professional standards' analysis (Neuendorf, 2017). The process of defining the variables necessary begins with the thorough presentation of each professional standard related to internally generated intangible assets.

The main hypothesis for the current paper is that the professional standards share a similar approach to internally generated assets' valuation and recognition. The aim of the similarity analysis will be to show the convergence and the divergence of the standards on specific framework segments pertaining to internally generated intangible assets.

Description of the content of the professional standards

An overview of IAS 38

Area of implementation and exceptions

IAS 38 regarding intangible assets outlines the accounting requirements for intangible assets, which are non-monetary assets without physical substance and uniquely identifiable (either by being separable or arising from contractual or other legal rights). Intangible assets meeting the relevant recognition criteria are initially measured at cost, subsequently measured at cost or using the revaluation model, and amortized on a systematic basis over their useful lives (unless the asset has an indefinite useful life, in which case it is not amortised) (IASB, 2022).

The objective of IAS 38 is to prescribe the accounting treatment for intangible assets; which are not treated, specifically, according to another IFRS. The Standard requires an entity to recognize an intangible asset if, and only if, certain criteria are met. The standard also specifies how to measure the carrying amount of intangible assets and requires certain disclosures regarding intangible assets (IASB, 2022: IAS 38.1).

At this point it is important to mention certain basic definitions related to the topic that will facilitate a more cohesive understanding of the framework.

The definition of the intangible asset itself: an identifiable non-monetary asset without physical substance. An asset is a resource that is controlled by the entity as a result of past events (for example, purchase or self-creation) and from which future economic benefits (inflows of cash or other assets) are expected. (IASB, 2022: IAS 38.8) Thus, the three critical attributes of an intangible asset are:

1. identifiability
2. control (power to obtain benefits from the asset)
3. future economic benefits (such as revenues or reduced future costs)

Identifiability is the most complicated attribute as a concept and thus some elaboration is in order: an intangible asset is identifiable when it: (IASB, 2022:IAS 38.12) is separable (capable of being separated and sold, transferred, licensed, rented, or exchanged, either individually or together with a related contract) or arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity or from other rights and obligations (Negkakis, 2015; Mirza et al., 2008).

Recognition and valuation requirements

The recognition and valuation of intangible assets must meet the following requirements:

- The definition of the intangible asset as mentioned above
- the recognition criteria

These requirements are valid for the costs regarding the initial generation as well as any additions, replacements or maintenance. However, replacements and additions are uncommon for intangible assets with the exception of whichever is defined in the interpretation of IFRS 20 stripping costs in the production phase of a surface mine (Negkakis, 2015).

Negkakis and Tachinakis (2013) provide some clarifications regarding the definition, specifically they describe the unclear term identifiable as to be distinguished so that any financial benefits could be sold, traded or borrowed.

In terms of recognition IAS 38 requires an entity to recognize an intangible asset, whether purchased or self-created (at cost) if, and only if (IASB, 2022:IAS 38.21)

- it is probable that the future economic benefits that are attributable to the asset will flow to the entity; and
- the cost of the asset can be measured reliably.

This requirement applies whether an intangible asset is acquired externally or generated internally. As long as the definition and the recognition criteria are met then the asset can be initially valued at cost (Negkakis, 2015; Mirza et al., 2008).

Intangible asset categories based on possession method

It is often difficult and complicated to assess whether an internally generated intangible asset qualifies for recognition because of problems in:

1. Identifying whether and when an identifiable asset comes into existence that will generate expected future economic benefits; and
2. Determining the cost of the asset reliably. In some cases, the cost of generating an intangible asset internally cannot be distinguished from the cost of maintaining or enhancing the entity's internally generated goodwill or of running day-to-day operations.

Hunter et al. (2012), seem to agree that managers are challenged by the task of measuring intangible related inputs and output in a clear and concise manner that would attribute values per intangible with precision.

In addition to complying with the general requirements for the recognition and initial measurement of an intangible asset, an entity applies additional requirements and guidance to all internally generated intangible assets.

To assess whether an internally generated intangible asset meets the criteria for recognition, an entity classifies the generation of the asset into:

1. a research phase; and
2. a development phase.

Although the terms 'research' and 'development' are defined, the terms 'research phase' and 'development phase' have a broader meaning for the purpose of this standard.

If an entity cannot distinguish the research phase from the development phase of an internal project to create an intangible asset, the entity treats the expenditure on that project as if it were incurred in the research phase only. However, obviously entities could possibly abuse the distinction since it would accumulate massive losses in their financial statements, at least until their intangible asset would begin to generate some profits, assuming of course that it is a startup company relying strictly on that single project coming to fruition. In other cases, with projects in various stages, such a method would decrease the entity's profits by the cost of resources dedicated to research as well as development (Negkakis, 2015;IASB, 2022).

The following diagram illustrates how the two phases evolve over time:

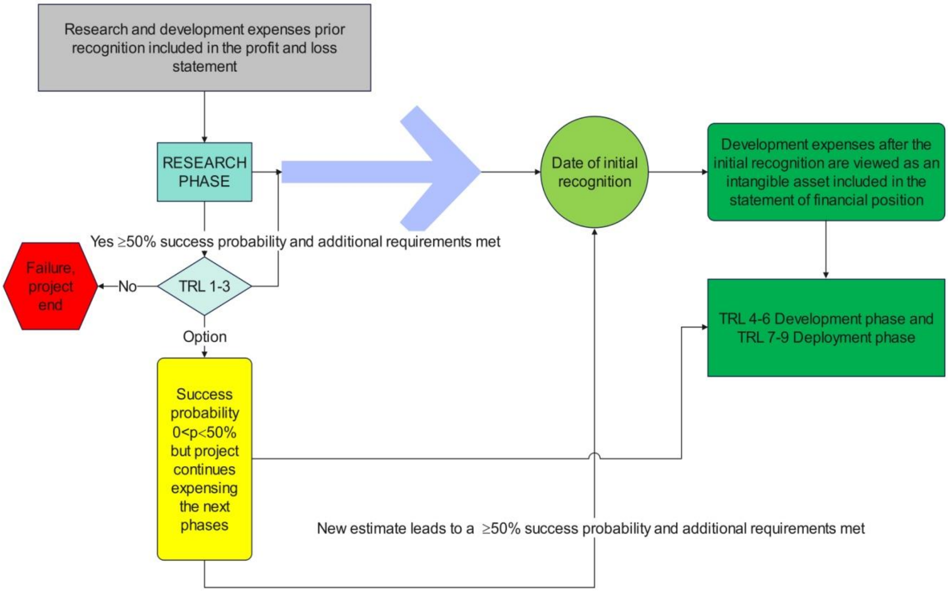

Diagram 1 R&D Phases and Relevant Decisions
Source: author's own projection

Intangible assets with finite useful life

Amortisation commences at the point in time when the intangible asset becomes ready for use or it is in the appropriate operating condition and position according to the management. On the other hand, the amortisation ceases at the former between the date of sale availability and retirement of the intangible asset (IASB, 2022).

In regards to the residual value of an intangible with finite useful life, it should be zero unless there is a third party commitment to buy the asset at the end of its useful life or there is an active market for it with the capability to determine the residual value through that market which would also present the possibility of a purchase at the end of its useful life. The revision of the residual value should be at least annual, at the end of the fiscal year and any alterations should be treated according to IAS 8. It is noted that any increase of the residual value can be larger than or equal to the book value, while the amortisation should be zero until the subsequent decrease of the residual value below the book value (Negkakis, 2015).

Intangible assets with indefinite useful life

The intangible assets with indefinite useful life cannot be amortized. However, according to IAS 36, an inspection of the intangibles is required to determine any impairment to the recoverable amounts in comparison with the book value. The inspection should take place annually and whenever there is an indication of impairment.

The following diagram illustrates how the intangible asset's useful life is treated:

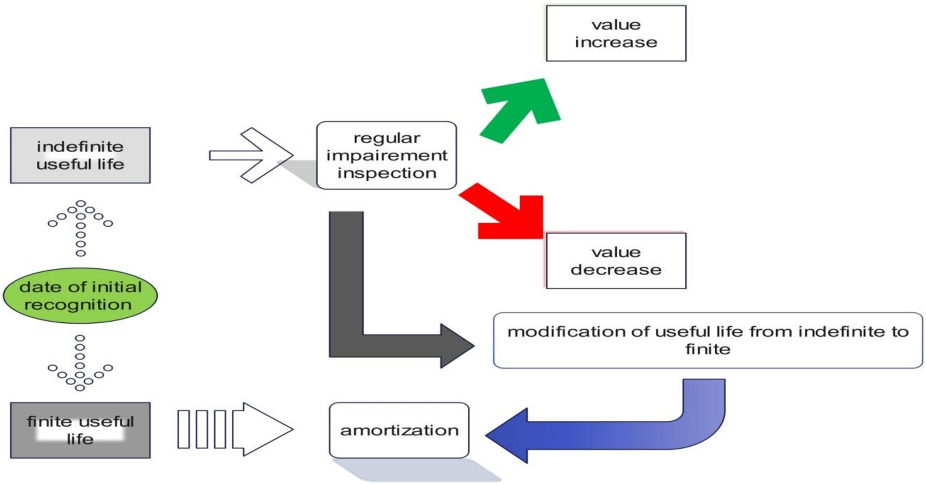

Diagram 2 Treatment Depending on the Useful Life of the Intangible
Source: author's own projection

An overview of IVS 210

The definition of intangible assets provided by the IVSC (2021) is "An intangible asset is a non-monetary asset that manifests itself by its economic properties. It does not have physical substance but grants rights and/or economic benefits to its owner." The definition is similar to the one observed in IAS 38, although there is a clear emphasis here to the economic properties of the asset as an indication of creation (Parker, 2016).

The intangibles are classified, by valuation regulators, in five distinct categories, the intangibles that interest this article belonging in the fifth category described as: "Technology-based: Technology-related intangible assets that arise from contractual or non-contractual rights to use patented technology, unpatented technology, databases, formulae, designs, software, processes or recipes." The hard science patents and software clearly belong in this category. As a result, the valuation method indicated as most suitable for this category or its elements will be the one of most interest.

The standard also provides a list of purposes concerning intangible asset valuations; among these purposes are financial reporting purposes, tax reporting purposes and litigation disputes. All of which have been mentioned as important to stakeholders (Parker, 2016).

The subject intangible items of this paper would fall broadly under the category of technology. The practical difficulty of this approach is to distinguish the revenue portion attributed to the specific subject intangible asset. For example, a mobile phone usually incorporates thousands of patents so it is difficult to separate which part of the phone's cost is resulting from each patent or other intangible asset (Leroux and Quenedey, 2011).

The treatment of intangible assets from an auditing standard perspective and other issues

The auditing landscape, while meticulously structured through various standards, occasionally presents areas of nuanced complexity. Among these, the International Auditing and Assurance Standards Board's (IAASB) ISA 620 stands out, primarily focusing on the "use of the work of an auditor's expert" rather than explicitly addressing intangible assets or a specific asset category. Despite this, the evolving nature of intangible assets, often rooted in groundbreaking research and innovation, necessitates a deeper exploration of their audit implications. This discourse aims to shed light on the unique challenges and considerations inherent in the audit of intangible assets. Additionally, the discourse highlights the standard's relevance to intangible assets but also navigates the broader implications for audit practice, particularly in ensuring the accuracy and integrity of financial reporting in this complex domain. There is no dedicated international standard on audit regarding intangible assets (IAASB, 2021). Perhaps the only, indirectly relevant, international standard on audit is the ISA 620, where the "use of the work of an auditor's expert" is mentioned (IAASB, 2021). It is the case of "the valuation of complex financial instruments, land and buildings, plant and machinery, jewellery, works of art, antiques, intangible assets, assets acquired and liabilities assumed in business combinations and assets that may have been impaired" (IAASB, 2021).

The involvement of experts, while indispensable for their insight and proficiency in these unique domains, introduces a layer of complexity to the audit process (Cheng et al., 2016; Kuo and Lee, 2017). This complexity stems not only from the specialized nature of the assets but also from the potential risks associated with the expert's deep engagement with the entity's confidential and sensitive information. Looking closer, into the implications of such expert involvement, it becomes apparent that ensuring objectivity and mitigating information leak risks are paramount, thereby setting the stage for a discussion on the standard's provisions for managing these challenges and the broader implications for audit cost and security.

Tuttici et al. (2007) investigated the effect of the auditors' size and reputation in combination with the securities commission's enhanced monitoring. The securities commission monitored if the publicly traded entities in Australia capitalised development costs in a prudent manner. Their results seem to indicate that the auditors' quality and the securities commission's vigilance motivate management to use development capitalisation more prudently than in cases where the auditor is not among the big four or the securities commission is lightly involved.

Methodology

This article introduces a dual-methodological approach designed to dissect the nuances of financial reporting, valuation and auditing standards.

Initially, the paper delves into Automated Textual Analysis, leveraging the computational prowess of Principal Component Analysis (PCA) via Voyant tools (version 2.6.2; Sinclair & Rockwell, 2023). This sophisticated analysis scaffolds an objective similarity assessment within a corpus encompassing pivotal standards: IAS 38 (IASB, 2022), IVS 210 (IVSC, 2021), and ISA 620 (IAASB, 2021). By processing these texts, PCA elucidates patterns and associations that may not be immediately apparent, presenting a quantitative metric of textual congruence that serves as a foundation for further qualitative scrutiny. An Automated Textual Analysis employs a statistical approach to compare texts, focusing on their quantifiable aspects rather than interpreting their intrinsic meanings, as outlined by Abdi and Williams (2010).

Following the delineation of professional standards in the previous Section, the initial phase embarks on an exhaustive content analysis, complemented by the precedent automated similarity analysis via Voyant tools (version 2.6.2; Sinclair & Rockwell, 2023). Anchored in the methodological frameworks proposed by Neuendorf (2017) and Miles et al. (2014), this multifaceted approach undertakes a meticulous scrutiny of each standard. The aim is to navigate through the textual corpus, pinpointing critical variables that resonate with the focal points of the research, followed by statistical analysis using similarity and dissimilarity measures.

According to Abdi and Williams (2010), Principal Component Analysis, commonly known as PCA, is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The process of creating these dimensions in PCA is a multi-step procedure that begins with the standardization of the feature set (Aggarwal, 2018; Bishop, 2006; Greenacre, 2007; Jollife, 2002). In practical terms, this means adjusting the original variables, which could be word frequencies in various documents, to have a standardized mean of zero and a standard deviation of one. This normalization is critical as it places all variables on the same scale, allowing for a fair comparison.

The PCA output is visually represented in a two-dimensional scatter plot, providing an intuitive grasp of the textual congruence among IAS 38, IVS 210 and ISA 620. This quantification lays the groundwork for deeper qualitative examination, directly tying back to the article's focus on R&D accountability and stakeholder protection.

The similarity analysis, crucial to this research, will unfold in two distinct yet interconnected methods. This bifurcated approach is essential for a meticulous dissection of the professional standards, ensuring a thorough and nuanced understanding of their provisions and implications.

It's crucial to note that unlike the PCA conducted using Voyant Tools (version 2.6.2; Sinclair & Rockwell, 2023), the second similarity analysis method transcends mere textual structure to consider the context and interpretative nuances of the standards' documentation. Content analysis, by its nature, involves a subjective interpretation of the text, aiming to capture the underlying meaning and implications, whereas PCA, in its automated form, primarily quantifies text, based on the frequency and distribution of terms, offering a more structural than semantic comparison (Abdi and Williams, 2010; Aggarwal, 2018; Bishop, 2006; Greenacre, 2007; Jolliffe, 2002).

Following the content analysis the analysis themes have been formed and are presented:

a) Recognition and measurement.

b) Disclosure and reporting.

c) Valuation of intangible assets

d) Audit considerations

The initial analysis theme centres on the concept of recognition and measurement, pivotal to accounting and valuation standards. It establishes the conditions for the recognition of intangible assets and dictates their initial and subsequent measurement. IAS 38 emerges as the prevailing standard within this theme, offering explicit criteria for the recognition and measurement of intangible assets. Thorough analysis is required to understand the practical implications for accounting. The comparison of these criteria with those suggested in IVS 210 and ISA 620 aligns accounting recognition with valuation standards and auditing guidelines, ensuring consistency in financial reporting.

The second theme pertains to disclosure and reporting. Transparency in reporting is critical for stakeholders to comprehend the valuation basis of intangible assets and the assumptions influencing their value over time. Originating from IAS 38, this theme calls for detailed disclosure about valuation methods, useful life, and R&D expenditures, crucial for users of financial statements to evaluate the economic benefits of intangible assets. Examining how IVS 210 and ISA 620 address these disclosures reveals the extent of rigour and detail expected in valuation and auditing practices.

Addressing the valuation of intangible assets, the selection of appropriate valuation techniques and the application of fair value are significant in reflecting the true worth of intangible assets within financial statements. The major query financial statements aim to resolve is the accuracy and fairness of the presented values. Exploring IAS 38 is crucial, especially when used together with IVS 210. IVS 210 is important because it offers detailed instructions on how to apply acceptable methods for valuing intangible assets. This analysis is also focused on understanding the risks associated with the unpredictable and changing future advantages of intangible assets, which play a significant role in determining their value.

The final theme focuses on audit considerations. While no dedicated audit standard for intangibles exists, ISA 620 is the closest standard indirectly associated with intangible assets. It provides guidance on the use of valuation experts and the assessment of risks related to the valuation of intangible assets, essential elements of the audit process. Reflecting on how these considerations are manifested in IAS 38 and IVS 210 assists in evaluating whether financial statements present a true and fair view of the intangible assets' value. Furthermore, this theme encompasses the evaluation of management's estimates, a critical aspect of auditing intangible assets due to their subjective and complex nature.

Each theme has been meticulously chosen to reflect a crucial aspect of intangible asset accounting and valuation, ensuring a comprehensive analysis across the domains of recognition, measurement, disclosure, valuation, and auditing perspectives.

For every analysis theme, specific elements that represent variables have been formed after content analysis similar to the methodology presented by Deaconu and Buiga (2010). These analysis elements, which are used as binary variables within each theme, serve as pivotal points of scrutiny.

Under the theme of Recognition and Measurement, the variables include 'Recognition Criteria', 'Initial Measurement', 'Subsequent Measurement', and 'R&D Costs'. These elements are critical in establishing the conditions that intangible assets must meet to be recognized in the financial statements and the methodology applied in their valuation at inception and in subsequent periods. 'R&D Costs' specifically addresses the accounting treatment of research and development expenditures, which are often significant for intangible assets.

For Disclosure and Reporting, the variables are 'Valuation Method Disclosure', 'Useful Life Disclosure', and 'R&D Expenditure Disclosure'. These elements ensure that the financial statements provide a clear and complete picture of how intangible assets are valued and amortized over time, along with the expenses incurred in their development. The disclosures are instrumental for users of financial statements to assess the sustainability and the long-term profitability of the assets.

In the Valuation of Intangible Assets theme, the analysis is focused on 'Permitted Valuation Techniques', 'Use of Fair Value', and 'Guidance on Uncertainty'. These variables are central to understanding the methods and approaches permissible for valuing intangible assets, the role that fair value plays in this process, and how uncertainty is accounted for, which can significantly impact the valuation of such assets.

The final theme, Audit Considerations, includes variables such as 'Risk Assessment', 'Use of Valuation Experts', and 'Evaluation of Management’s Estimates'. These elements are key to the audit process, where the reliability and accuracy of the intangible asset valuations are verified. 'Risk Assessment' involves identifying and evaluating the risks associated with valuing intangible assets. 'Use of Valuation Experts' considers the necessity and impact of specialist input in the audit process, and 'Evaluation of Management’s Estimates' scrutinizes the assumptions and judgments made by management in the valuation of intangible assets.

Each analysis element within the respective themes is intricately linked to the overarching standards—IAS 38, IVS 210 or ISA 620 and plays a vital role in the rigorous framework for accounting, reporting, valuation, and auditing of intangible assets. These elements collectively form the basis for addressing the second research question: Are the provisions of the standards sufficient to ensure R&D accountability and shareholder protection? By dissecting the components of recognition criteria, disclosure norms, valuation techniques, and audit processes, the analysis aims to determine the adequacy of these standards in promoting transparency and reliability in the reporting of R&D activities. The scrutiny of each variable contributes to a comprehensive understanding of whether the standards effectively safeguard shareholder interests by mandating accountability in the treatment and presentation of R&D investments. Thus, the examination of these elements is not just a study of compliance, but a critical appraisal of the standards’ capacity to uphold financial integrity and protect shareholders in the dynamic and often opaque realm of intangible asset valuation.

In the progression of the manual content analysis, the second critical phase begins, the similarity analysis, which draws inspiration from the methodology proposed by Deaconu and Buiga (2010). At this juncture, the binary variables delineated in the content analysis undergo a meticulous statistical examination. The variables are presented in Table 1 below. Echoing Deaconu and Buiga’s (2010) systematic approach, the process juxtaposes the attributes of the standards using a suite of statistical measures tailored to the binary nature of the data.

Table 1 presents the analysis themes and their relevant elements, variables. The table organizes information across columns and rows: the columns represent the standards IAS 38, IVS 210, and ISA 620, indicating their applicability to various analysis elements. The rows are divided by the analysis themes, each listing specific binary variables evaluated across the standards.

Table 1. Variable Presentation per Analysis Theme and Standard

Analysis Theme	Analysis Element of the Theme	IAS 38	IVS 210	ISA 620
Recognition and Measurement	Recognition criteria	Present	Present	Absent
	Initial measurement	Present	Absent	Absent
	Subsequent measurement	Present	Absent	Absent
	R&D costs	Present	Absent	Absent
Disclosure and Reporting	Valuation method disclosure	Present	Present	Absent
	Useful life disclosure	Present	Present	Absent
	R&D expenditure disclosure	Present	Absent	Absent
Valuation of Intangible Assets	Permitted valuation techniques	Present	Present	Present
	Use of fair value	Present	Present	Absent
	Guidance on uncertainty	Present	Present	Present
Audit Considerations	Risk assessment	Present	Present	Present
	Use of valuation experts	*Present	*Present	Present
	Evaluation of management's estimates	Present	Present	*Present

*Present means the specific information is typically expected to be covered by the standard, but a direct quote was not provided from the content analysis.

Source: Author's own projection

Table 1 presents values derived from an in-depth content analysis for each thematic element, which will be encoded as binary nominal variables in SPSS (IBM

Corp., 2017) to perform similarity and dissimilarity assessments. For each variable ‘present’ is coded as value 1 and ‘absent’ as value 0.

Key to this phase is the judicious selection of similarity measures. This choice is predicated on the characteristics of the data gleaned from the content analysis and incorporates an array of statistical instruments. These include non-parametric correlations apt for binary variables such as the Simple Matching Coefficient, Dice, Rogers and Tanimoto coefficient, Sokal and Sneath I coefficient, Jaccard coefficient and the Euclidean Distance Coefficient, which is a dissimilarity measure (Han et al., 2012; Tan et al., 2014). This eclectic mix of tools reflects the thorough approach embodied in Deaconu and Buiga’s (2010) work, ensuring a comprehensive and multi-faceted examination of the standards.

The similarity measures are calculated as follows: The simple matching coefficient is calculated by taking the number of matching attributes (both present and absent) and dividing by the total number of attributes (Tan et al., 2014).

The range of values are from 0 to 1, where a value of 1 indicates perfect similarity (all attributes match), while a value of 0 indicates no similarity (no attributes match).

The Dice Coefficient is calculated as two times the count of common elements between both sets over the sum of elements in set A and B. In this case the sets are the standards’ documents, ISA38, IVS 210 and ISA 620, interchangeably in sets of two. The Dice coefficient gives more weight to the number of shared attributes between the two sets. This can be particularly useful when assessing the similarity of two samples where the presence of common characteristics is more significant than their differences (Tan et al., 2014). Again the values range from 0 to 1, where a value of 1 indicates perfect similarity (all attributes match), while a value of 0 indicates no similarity (no attributes match).

The Rogers and Tanimoto coefficient is calculated by taking the sum of matching present and absent attributes and dividing by the sum of this number plus twice the sum of non-matching attributes, it is similar to the simple matching coefficient but puts more emphasis on the disagreements (Han et al., 2012;Tan et al., 2014). Again the values range from 0 to 1, where a value of 1 indicates perfect similarity (all attributes match), while a value of 0 indicates no similarity (no attributes match).

The Sokal and Sneath 1 coefficient is another variant of similarity measure that adjusts for agreements and disagreements, calculated similarly to Rogers and Tanimoto but with different weights (Tan et al., 2014).

Again the values range from 0 to 1, where a value of 1 indicates perfect similarity (all attributes match), while a value of 0 indicates no similarity (no attributes match).

The last similarity measure is the Jaccard coefficient, it is calculated as the size of the intersection of two sets divided by the size of the union of the sets, once again its values range from 0 to 1. A value of 1 means the sets are identical; a value of 0 means they share no elements and most notably, it does not consider the joint absence of attributes (Han et al., 2012;Tan et al., 2014).

The Euclidean distance coefficient is a dissimilarity measure which is based on the 'straight line' distance between two points in multidimensional space, calculated using the Pythagorean theorem as indicated by various publications (Bishop, 2006; Han et al., 2012; Hastie et al., 2008; Tan et al., 2014). The range of values starts from 0 and can go to infinity, where a value of 0 indicates no distance between points (perfect similarity), while higher values indicate greater dissimilarity. Unlike the other coefficients, which were similarity measures, for Euclidean distance, lower values signify similarity.

Leveraging the analytical prowess of SPSS (IBM Corp., 2017), the similarity scores that form the backbone of the analysis are calculated. SPSS serves not just as a calculation resource but as a critical interpretive ally, aiding in the elucidation of the complex relationships and distinctions between the standards.

The culmination of this phase is the analysis and synthesis of the quantitative findings into an intelligible narrative. This narrative is instrumental in unravelling the nuances of R&D accountability and the safeguarding of stakeholder interests within the ambit of professional standards. By harmonizing quantitative rigour with qualitative insight, this phase endeavours to unravel the layered complexity of the standards, offering an exhaustive and insightful exposition.

Results

Similarity analysis using automated text processing

The following scatter plot, referred to as Image 1, offers an insightful depiction of the similarity relationships among the IAS 38, IVS 210 and ISA 620 standards. Each point on the scatter plot represents a document from the corpus, namely IAS 38, IVS 210 and ISA 620, which have been uploaded to Voyant tools (version 2.6.2; Sinclair & Rockwell, 2023) as pdf document files. The spatial arrangement of these points reveals how similar these documents are in terms of their word usage. This visual representation, derived from the frequency matrices of the 53 most prevalent terms in the documents, serves as a preliminary similarity analysis. While the intricate calculations underpinning the principal component analysis (PCA) are automated and thus not detailed here, the significance of the axes is worth noting. The horizontal axis, or Dimension 1, accounts for 73.43% of the total variance, indicating its substantial role in differentiating the documents. The vertical axis, or Dimension 2, explains a lesser but still notable 26.57% of the variance.

The PCA scatter plot, generated by Voyant tools (version 2.6.2; Sinclair & Rockwell, 2023), shows that ISA 620 is positioned distinctly apart from IAS 38 and IVS 210, suggesting a relative dissimilarity with these standards. Conversely, IAS 38 and IVS 210 appear in closer proximity along the more influential Dimension 1, suggesting greater similarity between them based on the analysed terms. Despite this, the distance between IAS 38 and IVS 210 along Dimension 2 should not be overlooked, as it indicates there are still significant differences to consider.

The analysis presented in Image 1 underpins the distance of ISA 620 from the other two standards, namely IAS 38 and IVS 210. The rationale is that the initial PCA has highlighted fundamental dissimilarities with the other two standards, which may overshadow finer comparative nuances. Meanwhile, the relative closeness of IAS 38 and IVS 210 along the principal axis of variation warrants a deeper investigation to uncover the subtleties and specifics of their convergence and divergence.

This refinement of the analysis sets the stage for a focused evaluation of the IAS 38 and IVS 210 standards, examining their thematic overlaps and divergences to provide a robust understanding of their implications for R&D accountability and shareholder protection.

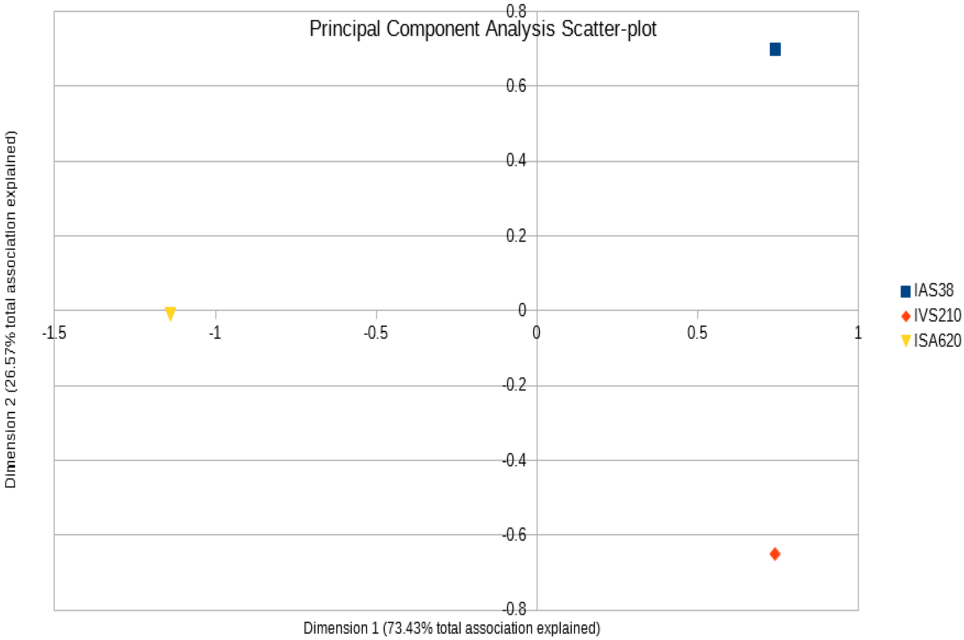

Image 1 PCA Scatter Plot Similarity Analysis
Source: Author's own projection

Dimension 2, orthogonal to Dimension 1, captures the secondary pattern of variance at 26.57%. The y-coordinates suggest a divergence between IAS 38 and IVS 210 along this dimension, as indicated by their opposite signs. IAS 38's positive y-value contrasts with IVS 210's negative y-value, implying that they differ in the secondary patterns of word usage captured by this component.

ISA 620, positioned at a y-value of zero, does not exhibit a significant positive or negative correlation with Dimension 2, suggesting its neutrality or lack of significant contribution to the patterns captured by this secondary dimension.

The scaling of the scatter plot is relative, and the actual values of the coordinates are influenced by the scaling and transformation process inherent in PCA. There are no fixed minimum or maximum values for these coordinates; rather, their range is determined by the spread of the original data, the standards' documents, across the calculated dimensions.

Elucidating Standards' Similarity: A Manual Content Analysis Approach processed with/in SPSS

The next tables contain the results of the SPSS (IBM Corp., 2017) similarity and dissimilarity measures for the binary variables per analysis theme in standard pairs.

Table 2. Comparison Analysis Results on Recognition and Measurement Theme

Binary Variables	Analysis theme: Recognition and Measurement		
Measures	IAS 38/IVS 210	IAS 38/ISA 620	IVS 210/ISA 620
Simple matching coefficient*	0.25	0	0.75
Dice*	0.4	0	0
Rogers and Tanimoto coefficient*	0.143	0	0.6
Sokal and Sneath I coefficient*	0.4	0	0.857
Jaccard coefficient*	0.25	0	0
Euclidean distance coefficient**	1.732	2	1

Notes: *Similarity measure; **Dissimilarity measure

Source: Author's own projection

In the detailed similarity analysis of the 'Recognition and Measurement' theme presented in Table 2, the binary variable measures were calculated to discern the extent of alignment between IAS 38/IVS 210, IAS 38/ISA 620, and IVS 210/ISA 620. This theme, which includes pivotal elements such as recognition criteria, initial and subsequent measurement, and R&D costs, forms the foundation of accounting for intangible assets.

When considering measures that primarily focus on the presence of attributes, such as the Jaccard coefficient, the analysis revealed a moderate similarity of 0.25 between IAS 38 and IVS 210, and no similarity between IAS 38, and ISA 620. This indicates a substantial disparity between IAS 38, IVS 210 and ISA 620 in the acknowledgment and quantification of R&D costs, suggesting divergent methodological approaches in the standards.

On the other hand, measures that account for both the presence and absence of attributes, such as the Simple matching coefficient and the Rogers and Tanimoto coefficient, demonstrated a higher degree of similarity between IVS 210 and ISA 620, with values of 0.75 and 0.6 respectively. This reveals a nuanced compatibility in the absence of certain criteria as well as their presence, suggesting a broader congruence in their overall frameworks for recognition and measurement.

The Dice and Sokal and Sneath I coefficients, which balance the importance of present and absent values, showed a more pronounced similarity between IAS 38 and IVS 210 with values of 0.4, indicating a shared perspective in the treatment of R&D. However, these coefficients registered no similarity between IAS 38 and ISA 620, underscoring the stark contrasts in their respective standards.

The Euclidean distance coefficient, a dissimilarity measure sensitive to the absence of shared attributes, corroborated these insights by revealing greater distances between IAS 38 and ISA 620 at 2, and a lesser distance between IVS 210 and ISA 620 at 1. This aligns with the earlier observations of IVS 210 and ISA 620 sharing more in common, potentially due to similar omissions in the standards, than either does with IAS 38.

These measures collectively highlight the intricate dynamics of standard provisions. They underscore the importance of considering both the presence and absence of criteria in the complex landscape of intangible asset accounting, thereby offering a comprehensive view of the standards' alignment and divergence in ensuring R&D accountability and stakeholder protection.

Table 3. Comparison Analysis Results on Disclosure and Reporting Theme

Binary Variables	Analysis theme: Disclosure and Reporting		
Measures	IAS 38/IVS 210	IAS 38/ISA 620	IVS 210/ISA 620
Simple matching coefficient*	0.667	0	0.333
Dice*	0.8	0	0
Rogers and Tanimoto coefficient*	0.5	0	0.2
Sokal and Sneath I coefficient*	0.8	0	0.5
Jaccard coefficient*	0.667	0	0
Euclidean distance coefficient**	1	1.732	1.414
Notes: *Similarity measure; **Dissimilarity measure			

Source: Author's own projection

As indicated in Table 3, in the thematic exploration of 'Disclosure and Reporting' within financial standards, the binary variables highlight how IAS 38 and IVS 210 often align in their disclosure requirements, as evidenced by a Simple matching coefficient of 0.667. This suggests a substantial overlap in the presence of disclosure elements between these two standards, indicating a shared commitment to transparency in valuation methods, useful life estimations, and R&D expenditure reporting.

The Dice coefficient amplifies this observation, with a high score of 0.8, underscoring that not only do these standards have similar disclosure requirements, but also that these requirements constitute a significant portion of their reporting frameworks. This is indicative of a concerted effort by the standards to ensure that valuation methodologies and the expected longevity of assets are clearly communicated.

However, when comparing IAS 38 with ISA 620, the absence of a similarity score across all measures, and the high value of the Euclidean distance coefficient of 1.732, points to a stark contrast between IAS 38 and ISA 620. This divergence suggests that ISA 620's disclosure requirements are either not as extensive or are approached in a fundamentally different manner compared to IAS 38, which may lead to variations in stakeholder interpretation and understanding.

Similarly, IVS 210 and ISA 620 show a modest Simple matching coefficient of 0.333 and a Rogers and Tanimoto coefficient of 0.2, indicating some commonalities in their absence of disclosures, yet these figures also reflect notable differences in the standards. The modest score in the Sokal and Sneath I coefficient at 0.5 reaffirms this notion, suggesting that while there are some convergences, there is also a discernible disparity in the reporting obligations under these standards.

Interestingly, the Jaccard coefficient for the comparisons involving ISA 620 consistently registers zero, reinforcing the notion that when it comes to the presence of specific disclosure items, ISA 620 diverges significantly from the other two standards.

The Euclidean distance coefficient, which serves as a dissimilarity measure, provides a numerical representation of the gaps between the standards, with higher distances indicating greater divergence. A distance of 1 between IAS 38 and IVS 210 is the smallest among the comparisons, denoting closer proximity and a smaller gap in disclosure practices, whereas the distance of 1.732 between IAS 38 and ISA 620 is indicative of a more pronounced disparity, which is mirrored by the distance of 1.414 between IVS 210 and ISA 620.

These findings, encapsulated within the 'Disclosure and Reporting' theme, reveal a complex web of disclosure requirements, where IAS 38 and IVS 210 share a closer affinity, and ISA 620 stands apart. It is important to contextualize the role of ISA 620. While IAS 38 and IVS 210 are standards dedicated explicitly to the treatment of intangible assets, ISA 620 is associated with intangibles indirectly through its guidance on using experts in audits. As such, the mentions of intangible assets within ISA 620 are incidental and not the primary focus, which explains the limited disclosure requirements related to intangible assets when compared to IAS 38 and IVS 210. This nuanced context underscores why ISA 620 exhibits a significantly different profile in the similarity analysis, reflecting its distinct purpose and scope within the financial reporting and auditing landscape. This delineation is vital for understanding the nuances of stakeholder protection and the sufficiency of R&D accountability as prescribed by these standards.

Table 4. Comparison Analysis Results on Valuation of Intangible Assets Theme

Binary Variables	Analysis theme: Valuation of Intangible Assets		
Measures	IAS 38/IVS 210	IAS 38/ISA 620	IVS 210/ISA 620
Simple matching coefficient*	1	0.667	0.667
Dice*	1	0.8	0.8
Rogers and Tanimoto coefficient*	1	0.5	0.5
Sokal and Sneath I coefficient*	1	0.8	0.8
Jaccard coefficient*	1	0.667	0.667
Euclidean distance coefficient**	0	1	1
Notes: *Similarity measure; **Dissimilarity measure			

Source: Author's own projection

For the 'Valuation of Intangible Assets' theme, as indicated in Table 4, measures like the simple matching and Jaccard coefficients, which focus primarily on the presence of attributes, suggest a strong similarity between IAS 38 and IVS 210, with a perfect match indicated by a coefficient of 1. These measures show that where valuation techniques, the use of fair value, and guidance on uncertainty are explicitly mentioned (present), IAS 38 and IVS 210 are in complete agreement.

The Dice and Sokal and Sneath I coefficients, which also consider the absence of attributes, reinforce this alignment, indicating a robust congruence in both what is included and excluded within the standards. This suggests that not only do IAS 38 and IVS 210 share common valuation elements, but they also concur on what is not considered or excluded from their provisions.

The Rogers and Tanimoto coefficient, which gives equal weight to matches on both present and absent attributes, still presents a perfect score of 1 for IAS 38 and IVS 210. This implies that both the presence and absence of valuation elements are harmoniously mirrored across these two standards.

The Euclidean distance coefficient, being a dissimilarity measure, corroborates the similarity findings by indicating no distance between IAS 38 and IVS 210. This indicates a perfect alignment and no divergence in valuation practices as prescribed by these standards.

When considering ISA 620, the moderate values across similarity measures indicate that, while ISA 620 does pertain to valuation through its guidance on the use of experts, it does not match the specificity and focus of IAS 38 and IVS 210 on the valuation of intangible assets. The Euclidean distance coefficients of 1 for comparisons involving ISA 620 align with this interpretation, suggesting a clear but not extreme departure from the other two standards.

In summary, the analysis underscores a nuanced difference: IAS 38 and IVS 210 are tightly coupled in their approach to the valuation of intangible assets, sharing a common framework for both the inclusion and exclusion of valuation elements. ISA 620, while still relevant to the valuation process, operates from a different vantage point, focusing on the auditing aspect and the use of expert valuations, which is reflected in its moderate similarity scores and corresponding dissimilarity distance.

Table 5. Comparison Analysis Results on Audit Considerations Theme

Binary Variables	Analysis theme: Audit Considerations		
Measures	IAS 38/IVS 210	IAS 38/ISA 620	IVS 210/ISA 620
Simple matching coefficient*	1	1	1
Dice*	1	1	1
Rogers and Tanimoto coefficient*	1	1	1
Sokal and Sneath I coefficient*	1	1	1
Jaccard coefficient*	1	1	1
Euclidean distance coefficient**	0	0	0
Notes: *Similarity measure; **Dissimilarity measure			

Source: Author's own projection

The 'Audit Considerations' theme, shown in Table 5, presents a strikingly uniform set of results across all measures and pairings of the standards. With each similarity coefficient measuring at 1 and the dissimilarity (Euclidean distance) coefficient at 0, this suggests an absolute congruence between IAS 38, IVS 210, and ISA 620 in terms of the elements under this theme: risk assessment, the use of valuation experts, and the evaluation of management's estimates.

Given that these measures, whether emphasizing the presence of attributes or a combination of both presence and absence, yield a perfect score, we can infer that these three standards share a completely aligned approach in their audit considerations. This alignment is quite comprehensive, as it does not vary across different types of measures those sensitive only to the presence of attributes and those sensitive to both presence and absence alike.

In interpreting these results, it's essential to note that while IAS 38 and IVS 210 directly address intangible assets, ISA 620 is associated with these assets indirectly through the audit process. Despite ISA 620's broader focus on auditing beyond just intangible assets, the findings indicate that when it comes to audit considerations relevant to intangible assets, ISA 620 fully aligns with the specific provisions of IAS 38 and IVS 210. This might be due to the nature of audit standards, which tend to be more universal and applicable across different areas of financial reporting, including intangible assets.

Thus, these results do not imply that ISA 620 is as detailed or prescriptive about intangible assets as IAS 38 and IVS 210 are; rather, it suggests that where ISA 620 does touch upon intangibles, it does so in a manner consistent with the frameworks established by the other two standards. This consistency is crucial for ensuring the reliability and thoroughness of audits in the context of intangible assets and underscores the interconnectedness of standards when it comes to audit practices.

Table 6. Comparison Analysis Results on Overall Similarity

Binary Variables	Analysis theme: Overall similarity		
Measures	IAS 38/IVS 210	IAS 38/ISA 620	IVS 210/ISA 620
Simple matching coefficient*	0.692	0.385	0.692
Dice*	0.818	0.556	0.714
Rogers and Tanimoto coefficient*	0.529	0.238	0.529
Sokal and Sneath I coefficient*	0.818	0.556	0.818
Jaccard coefficient*	0.692	0.385	0.556
Euclidean distance coefficient**	2	2.828	2
Notes: *Similarity measure; **Dissimilarity measure			

Source: Author's own projection

The overall similarity analysis, encapsulating all the themes pertinent to intangible assets, yields a nuanced picture of the relationships between the standards IAS 38, IVS 210 and ISA 620. The Simple Matching Coefficient, which equally considers matches of both presence and absence of attributes, indicates a moderate similarity between IAS 38/IVS 210 and IVS 210/ISA 620, with scores of 0.692, and a less pronounced similarity between IAS 38/ISA 620, at 0.385.

The Dice coefficient and the Sokal and Sneath I coefficient, which give more weight to the presence of attributes, suggest a higher degree of similarity between IAS 38/IVS 210 and IVS 210/ISA 620, with values over 0.7, indicative of a strong overlap in the characteristics considered in these standards. The Jaccard coefficient, known for emphasizing the presence of attributes without giving weight to joint absences, presents a similar trend but with slightly lower similarity scores.

The Rogers and Tanimoto coefficient, with its balanced emphasis on both present and absent values, shows a relatively lower similarity across all pairings, most notably between IAS 38/ISA 620, where it drops to 0.238, underscoring the differences in their treatment of intangible assets.

The Euclidean distance coefficient, as a measure of dissimilarity, reinforces these findings with higher scores indicating greater divergence, particularly between IAS 38/ISA 620, which scores the highest at 2.828, suggesting the most pronounced differences between these standards.

It is important to consider that IAS 38 and IVS 210 are directly focused on intangible assets, while ISA 620's connection to intangibles is more tangential, reflected in the limited mentions of intangible assets within it. Therefore, the results for ISA 620, particularly in its comparison with IAS 38, must be interpreted with an understanding of its broader auditing scope, which may not delve into the specifics of intangible assets as deeply as the other two standards.

Overall, these similarity measures, with their varying focus on the presence and absence of attributes, provide a composite view of the congruity and divergence among the standards. They underscore the robust alignment between IAS 38 and IVS 210, while also highlighting the relative distance of ISA 620 due to its different purview and indirect association with intangible assets.

Conclusion

The conclusions drawn from these analyses are multifaceted. Firstly, they affirm the robustness of IAS 38 and IVS 210 in their convergent treatment of intangible assets, suggesting that stakeholders can rely on a coherent framework for R&D accountability.

Secondly, the consistency of ISA 620 with the other standards in audit-related aspects reinforces the reliability of audits concerning intangible assets, despite its broader scope.

The analysis conducted in this paper exposes inherent vulnerabilities within IAS 38, IVS 210, and ISA 620, particularly concerning the uncertainty embedded in managerial judgement and expert evaluations. The provision in IAS 38 that allows for the capitalisation of development costs based on a probability threshold opens the door to earnings manipulation, given that managerial incentives can skew the estimations of economic benefits (Dinh et al., 2015a). This subjectivity does not adequately safeguard against over or underestimation, which can be driven by motivations ranging from bonus optimization to tax advantages.

Similarly, IVS 210's (IVSC, 2021) reliance on discount rates for valuing intangible assets introduces an arbitrary element that may not reflect true risk, again inserting a layer of judgement into the valuation process. The standards, while offering a framework, do not provide a fail-safe mechanism to counter the potential arbitrariness of these estimations.

The challenges extend into the auditing domain, as illustrated by ISA 620. The requirement to seek expert opinions introduces additional costs and raises concerns over the confidentiality of proprietary information (Basu and Waymire, 2008; Ciftci and Zhou, 2016; Hunter et al., 2012). This is particularly relevant when considering the valuation and audit of advanced technologies, such as AI systems. The unique characteristics of such technologies, including their development costs, the expertise needed for their evaluation, and the difficulty in forecasting their generated cash flows, pose significant challenges (Warren and Casey, 2023, 'The Dichotomy of AI: MIT Professor Sandy Pentland Examines Whether It Poses a Threat or Opportunity to Humanity').

These observations are not merely theoretical; they have practical implications. For instance, considering an AI technology's development costs, raises questions about capitalisation and the practicality of finding an expert capable of auditing its complex capabilities without infringing on proprietary rights. Moreover, determining an appropriate discount rate for the projected cash flows generated by AI, and accounting for regulatory risks, presents complex dilemmas that the current standards do not explicitly address.

Therefore, the current standards, despite their intent to enhance accountability and protect stakeholders, fall short when confronted with the complexity and rapid advancement of intangible assets, particularly in the technology sector. Stakeholders are left to navigate a landscape where the standards provide insufficient guidance on practical applications, leaving a gap that could be exploited to the detriment of financial transparency and integrity.

The conclusion of this article, therefore, points to a need for the evolution of these standards. It calls for a framework that can more accurately reflect the risk, value, and uncertainty of intangible assets, especially cutting-edge technologies. Future iterations of these standards should consider incorporating more objective, quantifiable metrics and enhanced guidance to mitigate the subjectivity of managerial judgement and expert evaluations. The goal should be to construct a robust, adaptable framework that can keep pace with innovation and more effectively shield stakeholders from the risks inherent in the valuation and reporting of intangible assets.

Moving forward, these findings imply the necessity for continued harmonization of standards, particularly as the business environment evolves and the importance of intangibles escalates. Future revisions of standards should consider these alignment insights to further strengthen the framework for intangible assets and enhance stakeholder trust.

In conclusion, this paper establishes a clear picture of the current landscape of financial standards as they pertain to intangible assets. It paves the way for ongoing discourse on the efficacy of these standards in safeguarding shareholder interests and the transparent reporting of R&D activities, thus contributing to the broader goal of financial integrity in the global economy.

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