

IAS 41 – A step closer to accounting harmony?

Abstract

When IAS 41 was implemented the companies affected now had several measurement methods to choose from when valuing their biological assets. This paper examines to what extent these different measurement methods are used by forest owning companies. The Herfindahl Index and the I-index are used to quantify the degree of harmony of measurement methods within countries, irrespective of countries, and between countries. Data was collected from companies in Europe, South Africa, and Australia. Our findings conclude that the degree of national harmony is very high in Sweden, Finland, South Africa, and Australia. We also find that the degree of harmony of the forest industry as a group, irrespective of country of origin, is high. However, the I-index indicates that the degree of international harmony is very low for the countries investigated.

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1 Introduction

Since 1973 the Board of the International Accounting Standards Committee (IASC) and its successor the International Accounting Standards Board (IASB) have pursued the undertaking of developing and promoting International Accounting Standards (IAS, first developed by the IASC) and International Financial Reporting Standards (IFRS, developed by the IASB). With IFRS being used in more than 100 countries around the world, it would seem that the task of harmonizing global accounting standards is well on its way.¹ On the other hand, questions have been raised regarding how well IFRS actually creates homogeneity when implemented.²

Whatever the effects on harmonization, the influence of IASB is spreading not only through being adopted in more countries, but also through IFRS and IAS becoming more and more all-encompassing. Topics covered range from the more fundamental and conceptual standards to the more specific ones. One international accounting standard attempting to handle a rather specific area is IAS 41: Agriculture. This standard establishes standards of accounting for agricultural activity, that is, the management of biological assets (living plants and animals) and the transformation of those assets into agricultural produce (the harvested product of the biological asset).

Included in the aforementioned biological assets are standing forests, which in some sense are very different from traditional crops. This is especially so in terms of growing times and the life span of the plants involved. Because of this, the heart of IAS 41, i.e. the notion of measuring biological assets at fair value, may prove to be less straightforward and more of a problem for standing forests than for other biological assets. The reasons are many. First, the already hinted-upon issue of how to reliably measure the value of an asset 10, 50 or 100 years before its maturity and eventual sale poses a difficult challenge. This particular issue is further exacerbated by the fact that the value of forest assets is contingent on the value of the product into which the trees will be processed, chiefly timber or pulp. These too need to be estimated far into the future

¹ <http://www.iasb.org/Use+around+the+world/Global+convergence/IFRS+global+convergence.htm>
(Last accessed on 2010-05-14)

² Henry et. al 2009

which consequently further contributes to the uncertainty of the valuation. Second, even if an attempt to value the standing forest as-is, i.e. an estimated selling price for the forest asset in their current state, the forest holdings are often too large for a useful marketplace to exist. Related to this is the fact that most sales of forest assets are actually sales of forest estates, with not only the forest but also the land on which it is standing reflected in the price.

Until 2005, when compliance with IFRS and therefore IAS 41 became mandatory for listed EU companies, Swedish companies had not had to deal with these issues, instead typically using historical cost and write-ups where deemed necessary. Now, the Swedish forest industry as a whole has determined that the best way of capturing the fair value of the forests is to use a variation of the discounted cash flow model. Typically, this is not considered an optimal way of determining fair value, but the Swedish forest companies seem to argue that alternative methods are inferior or impossible to use.

2 Purpose

Our intent is to write our thesis based on International Accounting Standard 41 (IAS 41) and the measurement of biological assets. In our case, we will focus solely on forest assets.

While exclusively looking at Swedish forest companies' choice(s) of measurement method is a possible area of interest, we believe that further insights can be gleaned from an inter-country comparison across the industry. By taking a step back and looking at the issue from a perspective less tainted by local concerns and peculiarities, we expect to be able to analyze the implementation of IAS 41 in a more general, fair and objective manner.

We hope to be able to analyze several interwoven issues and touch upon the nature of the accounting harmonization achieved through the adoption of IFRS and the specific set of problems associated with implementation of IAS 41 and the measurement of forest assets at fair value. More precisely, we will investigate, analyze and discuss the choice of measurement method across companies on a national and international level, and compare how forest assets are handled in the accounts after the adoption of IAS 41.

The specific problem around which our study will revolve is thus: How does the measurement of the value of forest assets in accordance with IAS 41 differ among forest owning companies?

3 IAS 41

This first section of the paper is a short synopsis of the most pertinent parts of IAS 41, with a special focus on the area most relevant to us: measurement methods. As mentioned in the introduction, IASB is an international body with the objective “to develop, in the public interest, a single set of high quality, understandable and enforceable global accounting standards”.³ The general idea is that this globally shared set of accounting standards should provide better, more transparent and more comparable pictures of the entities publishing financial statements, in order to enable the users of such information to make better decisions. In addition to developing such accounting standards, the IASB is also promoting the use and application of its standards, as well as working to bring about convergence and harmony of its accounting standards with the national counterparts.⁴

A discussion of the internal structure of the IASB and associated bodies is beyond the scope of this paper, as is any extensive scrutiny of the process preceding publishing or revision of IFRS. It is however prudent to briefly touch upon the relationship between International Financial Reporting Standards (IFRS) and International Accounting Standards (IAS). The latter, IAS, are those standards published by the IASB’s predecessor, the Board of the International Accounting Standards Committee. This body came into existence in 1973 as a result of an agreement among official or semi-official professional accounting organizations stemming from several European and Commonwealth countries as well as the USA, Mexico and Japan. The Board of IASC was replaced by the IASB in 2001, who at their first meeting resolved that “[a]ll Standards and Interpretations issued under [the Board of the IASC] continue to be applicable unless and until they are amended or withdrawn.”⁵ In essence then, IFRS is today a catch-all denomination for all standards and interpretations approved by the IASB, whether issued by the IASB or the Board of the IASC. Every IAS is an IFRS, but not every IFRS is an IAS.⁶

³ IASB as of 2010: Preface, paragraph 6

⁴ IASB as of 2010: Preface, paragraph 6

⁵ IASB as of 2010: Preface, paragraph 5

⁶ IASB as of 2010: Preface, paragraph 1, 4, 5

From the above follows that IAS 41 was first issued by the Board of the IASC. More exact, it was issued in February 2001, shortly before the creation of the IASB. The standard has been amended by several revisions of other IAS and new IFRS, most recently in November 2009.⁷

IAS 41 specifically deals with recommendations for accounting practices relating to agricultural activity, where agricultural activity is defined as “the management by an entity of the biological transformation and harvest of biological assets for sale or for conversion into agricultural produce or into additional biological assets”⁸.

IASB defines biological assets as living animals or plants, biological transformation as the change of those biological assets (through growth, degeneration, production and procreation), and agricultural produce as the harvested product a biological asset.⁹

So, in other words, IAS 41 prescribes how to account for and the degree of disclosure for matters relating to living assets throughout the assets’ lifecycles. We intend only to deal with forests and forest plantations, an arbitrarily defined subclass of biological assets. Therefore, for our narrower purpose, yet another appropriate description would be that the standard outlines the proper accounting treatment and disclosures for forests, and the trees said forests contain, throughout their life: from planting to harvest.

The IAS 41 stipulations for when to recognize a biological asset or agricultural produce are not any different from most other assets. The requirements for recognition comprise control as a result of past events, probable future economic benefits, and that fair value or cost of the asset can be measured reliably.¹⁰

As for measurement, the (pre-tax and independent of financing) fair value less cost to sell of the biological assets should be used. The biological assets should be measured both on initial recognition and at the end of each reporting period. Preferred method of valuation is fair value,

⁷ IASB as of the 31st of December 2009: IAS 41, version history

⁸ IASB as of the 31st of December 2009: IAS 41, paragraph 5

⁹ IASB as of the 31st of December 2009: IAS 41, paragraph 5

¹⁰ IASB as of the 31st of December 2009: IAS 41, paragraph 10

being defined as "(...) amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction."¹¹ A hierarchy of methods to determine value is presented and summarized in Table 1 below, with the methods listed in order of preference.¹²

Table 1: Measurement of value	
Circumstances	Method
Active market exists	Quoted market price
Active market does not exist	Market related price: Most recent transaction price (if necessary adjusted for any change in market conditions) Market price for similar assets, adjusted to reflect differences Sector benchmarks (e.g. value per m ³)
Relevant market prices not available	Present value of expected net cash flows from the asset (discounted at market-determined rate)
Relevant market prices not available and alternative methods clearly unreliable	Historical cost less accumulated depreciation and accumulated impairment losses
<i>Source: IASB as of the 31st of December 2009: IAS 41, paragraphs 17-24, 30</i>	

To avoid any misunderstandings a clarification the status of the valuations methods mentioned above is in place. Quoted market prices is the equivalent of fair value (as defined) and historical cost less accumulated depreciation is not. Market related prices (in all their forms) and present value of expected net cash flows from the asset are approximations of fair value accepted by IAS 41.¹³ In disregard of which of these valuation methods being used, a gain or loss at time of recognition, or a change in value, should be included in the profit or loss for the period.¹⁴

¹¹ IASB as of the 31st of December 2009: IAS 41, paragraph 8

¹² IASB as of the 31st of December 2009: IAS 41, paragraphs 5, 12-13

¹³ IASB as of the 31st of December 2009: IAS 41, paragraphs 17-24, 30

¹⁴ IASB as of the 31st of December 2009: IAS 41, paragraph 26

A noteworthy aspect of IAS 41 is that it actually allows historical cost as a valuation base for biological assets and, in extension, forests. This is a ‘reliability exception’ intended for use when any other method is unable to yield a reliable measure of the value of the asset in question.¹⁵

Lastly, a note related to a Swedish curiosity: to include the cost of replanting trees after felling is not permitted under the standard’s application. This means that this cost cannot affect the valuation of the forest assets.¹⁶ This is somewhat problematic because Sweden for example, has statutory silviculture regulations which state that trees felled for commercial purposes must be replanted.¹⁷

4 Measuring value

After, under IAS 41 above, having considered the most fundamental aspects of IAS 41, including the postulated methods to use for measurement of biological assets, we here take a step back and look at measurement of value from a more detached perspective. We first briefly examine the concepts underlying value and the general approach to measurement of value used in practice, before resuming our focus on biological assets and IAS 41 through putting the aforementioned concepts and approaches into the context of measuring the value of forests.

The most basic concept of value is derived from preferences and human wants. For example, if I would rather have an apple than a pear, the apple is worth more to me. However true it may be, such a basic and abstract notion of value is of little use in the context of a financial report. For the value concept to serve any purpose for the users of accounting information, the value of an asset needs to be concrete and stated in familiar and comparable terms. Simply put: the value of a resource or an effort must be converted from a relative order of preferences into an absolute monetary value.

The task of determining this monetary value, to measure it and make it useful, falls upon accounting. It can be a difficult task due to several related issues. Most obviously, what variables

¹⁵ IASB as of the 31st of December 2009: IAS 41, paragraph 30

¹⁶ IASB as of the 31st of December 2009: IAS 41, paragraph 22

¹⁷ Skogsvårdslag (1974:429) §5, §10 and Skogsvårdsförordning (1993:1096) §3

combine to form the preference of one asset over another, and what weights do these variables have in the determination of an asset's value? Also, how do the variables and/or their weights differ for different individuals or groups? In practice, it is virtually impossible to know all of the variables involved and their respective weights. This is especially true considering the subjective nature of preferences, and in extension, the subjective nature of value. Managers, investors, creditors and other stakeholders are likely to have different opinions of the value of an asset. The aforementioned problems are solved or circumvented through simplifying the measurement of value and using one of a number of more or less generally accepted measurement methods to arrive at a good enough approximation.¹⁸

4.1 Measurement methods

The numerous measurement methods are typically categorized as either based on cost or value. The specific category and method used in practice depends on the objective of the measurement and the type of decision it is meant to support.¹⁹

Cost is, simply enough, the amount of money necessary to acquire an asset, i.e. the price paid for it at initial recognition.²⁰ Under the usual assumptions of near-perfect markets, cost therefore provides a very good approximation of value at the time of the transaction. The problems with using cost as a measurement method lie in the passage of time and the potential for change in value during that time.²¹

We have divided the category pertaining to value further into *market value* and *present value*, for the simple reason that IAS 41 makes a distinction between market-based/-related measurements of value and present value. Independent of this categorization they are, if not defined as, equivalent of fair value.

¹⁸ Godfrey et al (2006), p. 487

¹⁹ Godfrey et al (2006), p. 487

²⁰ IASB as of April 2001: Framework, paragraph 100 (a)

²¹ Godfrey et al (2006), p. 489

Present value measurement methods are, as the name implies, based on the familiar present value calculation where estimated cash flows stemming from an asset are discounted by an estimated cost of capital rate:

Present value

$$= \sum_{t=1}^t \frac{CF_t}{(1+r)^t}, \text{ where } CF_t \text{ is net cash flows for period } t \text{ and } r \text{ is the cost of capital.}$$

As a measurement method, it is logically sound and easy enough to implement, but the quality of the output is greatly dependent on the quality of the input. Since the future cash flows for most non-monetary assets are difficult to ascertain, as is the cost of capital, it could be argued that the use of present value to measure value is limited.²²

Lastly, market value measurement methods are, again as the name implies, the value placed upon an asset in the market place. The market value is often considered to be objective and a very good estimate of the ‘true value’ of an asset, despite the fact that the perfect market underpinning many economic theories is rare, if not nonexistent, in reality. A functioning market consists of many buyers and sellers with different perceptions of value, perhaps mainly due to information asymmetry. Still, the market value may be the best estimate of an asset’s value we can have. After all, the sheer number of buyers and sellers on an active market should ensure that a consensus plausibly close to a reasonable value is achieved.²³

In Table 2 below, we try to summarize a few of the most frequently used measurement methods in simple terms. Historical cost, fair value, and value in use are the most pertinent to our discussion.

²² Godfrey et al (2005), p. 493f

²³ Godfrey et al (2006), p. 495f

Table 2: Sample of measurement bases	
Method	Definition
Historical cost	The amount paid at the time of the transaction.
Replacement cost	The cost to replace an asset at current prices.
Net realizable value	The expected selling price of an asset less the costs to bring the asset to a saleable state and finish the sales transaction.
Market value	The amount for which the asset or liability can be exchanged in the market place.
Fair value	The amount for which an asset <i>could</i> be exchanged or a liability settled between knowledgeable, willing parties in an arm's length transaction.
Value in use	The value of the asset to the business, in practice the present value of the expected net cash flows from the asset.
<i>Source: Godfrey et al (2006), p. 486</i>	

4.2 Measuring biological assets

The value of biological assets can be particularly difficult to ascertain. They are by definition self-generating/regenerating and are characterized by their ability to grow without significant input from their owner. A forest left on its own will grow with or without help from its human owners (although probably less so in the latter case) and animals are genetically inclined to pursue survival and reproduction, etc. This fact is also reflected in the controversy sparked by the requirement to measure biological assets at fair value.²⁴

It should be clear that the very passage of time makes biological assets more valuable. This makes most measurement methods based on cost unsatisfactory, as they fail to incorporate changes in value both due to growth and due to changing prices. Value in use is a more relevant method to measure value, but its reliance on estimates of future variables means it suffers in the reliability department though. A fair value, based on an existing and active market, presents the most relevant measure of value, but may be difficult to find for many biological assets. This is especially true for large forests, for which a liquid market, in practice, simply does not exist. It

²⁴ Godfrey et al (2006) p. 489

seems then, that all measurement methods face some form of shortcoming or difficulty when it comes to measuring the value of biological assets.²⁵

4.3 Measuring value according to IAS 41

IASB clearly prefer the more relevant measurement methods, with the hierarchy of preferred measurement methods resembling a gliding scale with the most market-related methods at the top (fair value) and the least market-related methods at the bottom (historical cost). Still, the reliability exception, which allows preparers to make a trade-off between fair value and reliability through allowing the use of historical cost, is a telling fact showing that the IASB is aware of the difficulties surrounding the measurement of the value of biological assets.²⁶

5 Accounting harmonization

The purpose of this paper, to analyze the how IAS 41 is used in forest owning companies, is tightly linked to the global harmonization of accounting and financial reports. As such, a thorough understanding of accounting harmony and previous research on this subject is desirable. We will begin by clarifying the concepts and definitions commonly used, move on to a short discussion on why accounting harmony and harmonization is desirable, and then round off this section of the paper with a look at the degree of accounting harmony and the state of the harmonization process as it is today.

5.1 Harmonization, standardization and uniformity

The first issue that crops up is what is actually referred to when using the term accounting harmonization. A variable number of expressions might be suitable and are used to describe the pervasive spread of accounting standards. Of these commonly used expressions harmonization is one and standardization and uniformity are two other. The concepts have a similar meaning, but there exists a significant difference in the degree of the phenomenon they are describing.

Van der Tas, in his presentation of the subsequently much used indices for quantification of harmonization of accounting practices, equates the process of harmonization to an increase in

²⁵ Godfrey et al (2006) p.489

²⁶ Godfrey et al (2006) p. 81

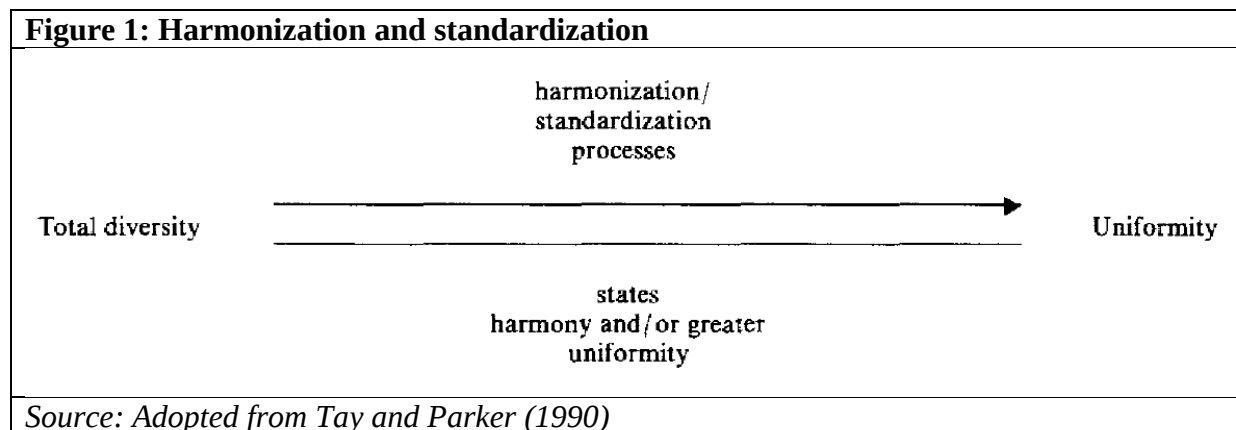
comparability: “**harmonisation is an increase in the degree of comparability** and means that **more companies in the same circumstances apply the same accounting method** to an event or give additional information in such a way that the financial reports of more companies can be made comparable. [Emphasis added.]”²⁷ He also makes a distinction between formal (i.e. de jure) harmonization and material (i.e. de facto) harmonization, where the former is the harmonization of standards issued by governments or private standard setting bodies and the latter is the actual harmonization of the accounting methods used. This distinction is important, since formal harmonization may actually lead to material dis-harmonization if the standards provide too many options. The implicit message is that what is important is that companies actually use the same methods to account for like events, rather than only having the option of using the same methods to account for like events. Van der Tas is also careful to point out that harmony should not be taken to mean rigid uniformity. Different circumstances could, and often should, lead to different accounting treatments in order to keep the information supplied in financial reports relevant.²⁸

The definitions used by Van der Tas are further formalized by Tay and Parker, in their critique of several previous studies of accounting harmonization. They provide more distinct definitions of harmonization, standardization, harmony and uniformity: “**Harmonization (a process) is a movement away from total diversity** of practice. Harmony (a state) is therefore indicated by a 'clustering' of companies around one or a few of the available methods. **Standardization (a process) is a movement towards uniformity (a state)**. It includes the clustering associated with harmony, and reduction in the number of available methods. [Emphasis added.]”²⁹

²⁷ Van der Tas (1988)

²⁸ Van der Tas (1988)

²⁹ Tay and Parker (1990)



One important aspect of Figure 1 above is that “[harmony] and uniformity are (...) not dichotomous. The former is any point on the continuum between the two states of total diversity and uniformity, excluding these extreme states”.³⁰ That is, that accounting methods are in harmony does not imply that the accounting methods are perfectly uniform. As for the processes of harmonization and standardization, they are, according to Tay and Parker, virtually the same process at different points on the scale. As Emenyonu and Gray points out, “[in] reality it might be very difficult to point out precisely at which point on the continuum an accounting regulatory process changes from harmonization to standardization”³¹

Despite the somewhat aged character of the above definitions, we believe they capture the essence of the terms in an adequate way. Harmonization and standardization are in this paper defined as processes implying movement away from diversity and towards uniformity respectively, and harmony is used to allude to a point on the scale between diversity and uniformity that is neither of the extremes. Further delving into semantics is beyond the scope of this paper.

³⁰ Tay and Parker (1990)

³¹ Emenyonu and Gray (1992)

5.2 The merits of accounting harmony

With the linguistic framework laid down, the next issue up for discussion is the actual merit of the harmonization of financial reporting and accounting methods. Why is a state of greater harmony, and in extension greater comparability, between financial reports desirable?

First of all, the most extreme result of a harmonization process, uniformity, may not be desirable at all. Whatever the perceptions of the public at large, accounting is a social science based on opinions and judgment. As a result of this, the discipline has an inherent flexibility which contributes to its usefulness. In certain situations, perhaps even most situations, this application of judgment and the resulting flexibility are necessities in order for accounting to serve its purpose. As such, a harmonization process should not be taken as far as to eliminate any semblance of diversity. There may not be a one-size-fits-all for accounting methods. For example, to apply the same accounting practices in an African developing country with rampant inflation as in the USA would not be suitable.³²

Still, harmonization and a greater degree of harmony are advantageous for several interrelated reasons, mostly in connection to the internationalization of capital markets. Differences in accounting methods and degrees of disclosure work to impede international trade and business expansions. This is so since “[dissimilarities] in national accounting standards and company reporting practices distort financial information and **reduce the level of effective communication to user groups**. [Emphasis added]”.³³ With investments flowing across country borders, the competition for capital becomes more intense and investors are faced with far more possibilities. In order for both companies and investors to make the best possible decisions, the information conveyed through financial reports must be comparable between countries and companies. “Accounting standards can cause the following effects: increased volatility in the net income figure, changing financial ratios and possible violations of debt covenant agreements.”³⁴

³² Fantl (1971)

³³ Tower et al (1999)

³⁴ Tower et al (1999)

5.3 Accounting harmony and harmonization in practice

”Across the EU, net income and shareholder’s equity reconciliation amounts differ significantly by industry and by legal origin of the firm’s home country, raising questions about the homogeneity of IFRS as implemented.”³⁵

One problem IAS 41 faces is that it incites many problems that might affect its extensive approval and hence, adoption as an accounting standard. This is mainly due to its character as the radical and final movement away from historic cost accounting.³⁶ A common belief is that fair value accounting is wide-spread but it has been shown that its prevalence generally is quite limited. Preferences of valuation model among companies show that cost accounting is preferred over fair value when both options are presented.³⁷

The International Accounting Standards are not only adopted by European countries but also in other parts of the world. In Australia they are adopted and reviewed by the Australian Accounting Standards Board (AASB) in which IAS 41 is represented through the accounting standard AASB 141 without any amendments.³⁸ Pre IAS 41, Australia had an accounting standard that regulated *Self-Generating and Regenerating Assets*, the AASB 1037. Another similar finding as mentioned in the previous paragraph was presented after a review of the 1999 annual reports in Australia where historic cost being the most favored method although net market value was proposed by AASB 1037. However, this is not at all surprising considering that managers in the Australian forest sector disliked the fact that the bottom line volatility would increase and be prompted by the periodic changes in the forest asset’s fair value.³⁹

Moving to mainland Asia, Hong Kong has also gone through a change in the area of financial reporting. SSAP 36, which is in effect since 1 January 2004, is the Hong Kong Financial Standard equivalent to IAS 41. They comment change as consistent in all aspects.⁴⁰ In South

³⁵ Henry et al (2009), p. 121

³⁶ Elad (2009) p.632

³⁷ ICAEW p.115

³⁸ http://www.charteredaccountants.com.au/financial_reporting/analysis_of_aasb_standards/aasb_and_ifrs_compared/A122042008 (2010-05-11)

³⁹ Elad (2009) p.635

⁴⁰ www.iasplus.com/hk/ifrs-hkgaap0310.pdf p.13

Africa the Accounting Standards Board (ASB) is the entity which sets standards guidelines for financial reporting as required.⁴¹ South Africa's GRAPs (General Recognised Accounting Principles) is primarily drawn from IAS and in the case of IAS 41 it has been the base for GRAP 101. Only minor changes have been issued for the sake of easing the transition to the new accounting standard for companies.⁴²

6 Methodology

To serve the purpose of this paper the method used is of quantitative nature. Our overall research strategy is based on a literature study to which we can compare our empirical findings.

Theory and previous research on the subject has mainly been collected through different accounting and business journals together with literature on valuation. The Stockholm School of Economic's library has been the starting point for our search.

The data retrieved for study is solely extracted from annual reports. Below is explained in further detail how our study was formed and executed.

6.1 Empirical Design

For us to conduct our research in a meaningful way and hence answer our two main questions on how the use of IAS 41 differs, certain variables are of great essence for comparability.

Forest assets can be measured in many different ways. In accounting monetary terms is the only variable of essence. However, the underlying foundation for the monetary measurement must be a quantitative physical unit. Several units are used to measure the forest:

- **Hectares** – measure of surface area (10 000 m³)
- **Cubic meters/Forest cubic meters** – measure of volume (fm³)
- **Fub-cubic meters** – measure of usable mass of stock volume (fubm³=0,8 m³)

⁴¹ <http://www.asb.co.za> (2010-05-11)

⁴² Accounting Standards Board GRAP 101 (2006)

To look at tendencies in the valuation within countries we have to find a measurement between one year's valuation and the previous year's valuation. If ignoring the term value for a moment the valuation must be set in relationship to a physical measure, since the amount of physical asset might change between the years set out of comparison. When looking at physical measurement units in the sake of comparison we can see that they have certain qualities that create uncertainty. This is because, for example, the density of trees and diversity of species may vary substantially between companies. Therefore hectares only can describe its original purpose; measuring surface area. Using (forest) cubic meters gives a better comprehension of how much useful material the broad term asset consists of. The tendencies in valuation were hoped to be observed through the quota "monetary value/fm³", and when that was not applicable we would use "monetary value/hectare".

When approaching the subject of harmonization we will mainly look for what methods of valuation the companies use. Apart from the choice of valuation method itself, the underlying assumptions on how these methods are chosen is of interest. As mentioned under 4.1 *Measurement Methods*, the quality of the output of the DCF model is greatly dependent on the input used. Of course, depending on which method being used, the range of the disclosed information will vary across the sample. But by looking deeper in to the disclosures we will be able to see how the actual models are applied in different countries and therefore be able to investigate and any certain patterns.

With this in mind, our target when entering the phase of retrieving data from the annual reports was to ingest information on

- Surface area (hectare)
- Volume
- Valuation method(s), including discount rate.

When extracting the data we were not able to find adequate information in a sufficient number of companies. Due to the poor nature of the supplementary disclosures in the annual reports on the assets in cubic meters, we therefore had to change our primary quota to "monetary value/hectare".

This is of course not optimal as mentioned above, but we still believe that certain information can be extracted from this approach.

In the case of this paper it is preferable with data as close as possible to the time of this writing. This paper has been worked on in the first part of 2010, at a time when the 2009 annual reports have not yet been released by some companies. Even though some financial information on last year can be found among these companies, the important supplementary information required for this paper are not disclosed in the financial information releases. Therefore, annual reports have been taken from the fiscal year ending the latest 31 December 2008.

A final note is that when presenting the data 7. *Empirical data* the term “quoted market price” *Table 1: Measurement of value* is changed to “selling price”, since that terminology is the one being used in the annual reports.

6.2 Sample

The sample that we would come to analyze has been chosen from a wide range of companies. The process of extracting companies to our study looks much like that of a funnel. The two main questions that we came across at an early stage were that of geographical location of companies and also which companies that could be major owners of forest.

Since IFRS compliance is required by all publicly traded companies in Europe, this was a natural starting point for the geographical scope. Through previous reports in the field of IAS 41 we learned that there is major forest owning companies in South Africa and Australia as well. In the case of the companies we found in South Africa all use IFRS. As mentioned in 5. *Accounting Harmonization* IAS 41 has its equivalent in Australia, although under a different acronym.

We found companies by searching through different countries where we could expect to find forest owning companies and to search more extensively we worked our way through stock exchanges in the geographical areas abovementioned. The first step was to use industrial classifications where “forestry and paper” and “materials” exclusively were used in our search. Through this, we found 33 companies and after reviewing their annual reports of 12 were deducted since they did not withstand the requirements of IAS 41, agricultural activity and in

more detail, biological assets for sale.⁴³ Great Southern plantations in Australia were rejected since they are in distress since beginning of 2009. In total we have 19 companies from 8 countries as base for our search to the question on how harmonized IAS 41 is when used. To look at the tendencies for the different companies' valuations, another 9 companies were excluded due to the poor disclosures, and even so lack of them, on the physical amounts of underlying asset (forest).

1. + 33 companies
2. – 12 companies (notwithstanding the requirements of IAS 41)
3. – 1 company (“going concern” not applicable)
4. – 1 company (not using IAS 41 prior January 1, 2009)
5. = 19 companies for study on harmonization
6. – 10 companies (poor disclosures on physical measurements of forests)
7. = 9 companies for study on valuations tendencies

⁴³ IASB as of the 31st of December 2009: IAS 41, Introduction, IN1

Table 3: List of companies for valuation comparisons		
Company	Legal origin	Fiscal year
Gunns	Australia	2007-2008
Timber Corporation	Australia	2008
Wilmott Forests	Australia	2008
Metsäliitto Group	Finland	2008
Stora Enso	Finland	2008
UPM KYMMENE	Finland	2008
China Forest Industry	Hong Kong	2008
Norske Skog	Norway	2008
Altri	Portugal	2008
Mondi	South Africa	2008
Sappi	South Africa	2008
South African Forestry Company	South Africa	2008
York Timbers	South Africa	2008
Bergs Timber	Sweden	2007-2008
Bergvik Skog	Sweden	2008
Holmen	Sweden	2008
SCA	Sweden	2008
Svea Skog	Sweden	2008
Precious Woods	Switzerland	2008

To comment on the sample we would like to make the reader aware of the fact that Stora Enso owns 43% of Bergvik Skog.

6.3 Data Analysis Method

Within the field of statistical interference many indices have been developed in order to better learn how to reach significant conclusions within quantifying harmonization. Without walking through all indices available we will explain our choices and ways to our findings.

Depending on point of view on harmonization there are different ways to approach the task of quantifying it. One way is to look just at the comparability of accounts through the financial reports of different companies, independent of which country they origin from. With this

approach the H-index qualifies as a good choice of quantifying method for measuring material harmonization.⁴⁴

The H-index was introduced in 1988 by Van der Tas in order to quantify the extent of harmonization and hence, the accounts of companies. The H-index (Herfindahl index) is a measure of concentration in which the relative frequencies of alternative accounting methods are weighted against each other:

$$H = \sum_{k=1}^M P_k^2$$

Where P_k is the relative frequency of accounting method (i. e. proportion of companies using accounting method k. In simple words the H-index describes the probability of from the sample two randomly selected companies having comparable accounts.⁴⁵ The H-index can be used not only to quantify national harmony to but also international: the difference is that when using it for international harmonization, the national borders are fictively eliminated and hence, creating one world. However, when studying more than two countries one of the index's properties becomes undesirable in the sense that countries which have many companies in the sample, get a larger weighting than countries with a small number of companies.⁴⁶

Backing up to the subject on different point of views on international harmonization, we will now take on another view. When searching for to which extent valuation methods are use per country we need to a different index. So, from a formal point of view it is recommended to apply the I-index instead.⁴⁷

⁴⁴ Van der Tas (1988) p. 165

⁴⁵ Taplin (2004) p.58-59

⁴⁶ Van der Tas (1988) p. 165

⁴⁷ Van der Tas (1988) p. 165

$$I = \left[\sum_{k=1}^M \left(\prod_{i=1}^N P_{ki} \right) \right]^{\frac{1}{N-1}}$$

P_{ki} is the proportion of companies in country I that use accounting method k. N equals the number of countries and M represents the number of accounting methods. The exponent is really an effort to create correction factor because the probability that companies use the same accounting method is when having a large number of companies, very small that of that a large number of companies. The I-index is actually the N-1st root of the probability that N randomly selected companies all use the same companies. This is intuitively not as easy to grasp as if there were only two companies which would be compared, but it is necessary for the index to work.

Here follows an example adopted from Emenyonu and Gray (1992)⁴⁸: We have three countries and the *Example 1* describes the distribution of the accounting methods in each country.

Example x: The I-index			
	Country		
	1	2	3
Method A	0,7	0,5	0,6
Method B	0,3	0,5	0,4

$$I - index = (0,7 \times 0,5 \times 0,6 + 0,3 \times 0,5 \times 0,4)^{\frac{1}{(3-1)}} = 0,52$$

⁴⁸ Emenyonu and Gray (1992) p.52

7 Empirical Data

This section is devoted to the presentation of the empirical data collected. Specific descriptions of how the sample was selected, the rationale for choosing what data to include and the logic behind any manipulation of the raw data are all explained in 6. *Methodology* above. Analysis of the herein depicted data is carried out in 8. *Discussion of Results* below. Here, the actual data is first presented grouped by legal origin and later from an international perspective.

7.1 Within countries

The 19 companies in our sample represent eight legal origins. The term “legal origins” is here used interchangeably with the more correct “countries”. The reason for the differing levels of correctness is the inclusion of a Hong Kong-based company and the situation concerning the use of Hong Kong Financial Reporting Standards (HKFRS) over the equivalent persisting on the Chinese mainland. As described in 6. *Methodology*, the legal origins are: Sweden, Australia, Finland, South Africa, Norway, Switzerland, Portugal, and Hong Kong.

The Swedish companies included are Bergs Timber, Bergvik Skog, Holmen, SCA, and Svea Skog. All of them use the discounted cash flow (DCF) measurement method to find the fair value of their forest assets. All of them also use a very similar weighted average cost of capital (WACC) as discount rate. Holmen is the most deviant in this respect, with a WACC of 5.50%. Bergs Timber too is slightly off the seemingly agreed-upon WACC with a WACC of 6.26% compared to the one used by the remaining three: 6.25%.

All Swedish companies in our sample cite a lack of an active market, market prices or other comparable values for assets the size of those they hold as the reason for their inability to use the selling price of their forest holdings when measuring the value said holdings.

As the same measurement method is used by all companies, the Herfindahl Index is naturally 1.0, indicating uniformity in choice of measurement method.

Table 4: Sweden		
Company	Method	Discount rate
Bergs Timber	DCF	6.26%
Bergvik Skog	DCF	6.25%

Holmen	DCF	5.50%
SCA	DCF	6.25%
Svea Skog	DCF	6.25%
<i>Source: Annual reports</i>		

For Australia, three companies are included, namely: Gunns, Wilmott Forests, and Timber Corporation. Once again we find uniformity in the choice of measurement method. All of them use, like their Swedish counterparts, the discounted cash flow method to determine the value of their forests. Unlike the Swedish companies however, the WACC used is different. Gunns use a WACC of 9.0%, Wilmott Forests use a WACC of 13.50%, and Timber Corporation use a WACC of 17.50%. It should be noted that Wilmott Forests do not forecast the future price of timber when calculating the value of their forests. Instead, they use the current price of timber, multiplied by the projected growth of the forests, to arrive at the positive cash flow stemming from the future sale of the timber. Timber Corporation too diverges from the norm through calculating the net present value of their forests using real terms. The actual net present value should theoretically become the same as if calculated using nominal terms (due to adjustments to numerators and denominators cancelling each other out), but the real WACC is not comparable in its raw state. Using the by Wilmott Forests assumed inflation rate of 2.50%, the corresponding nominal WACC is found through the relationship:

$$1 + r = \frac{1 + n}{1 + i}, \text{ where } r \text{ is the real rate, } n \text{ is the nominal rate, and } i \text{ is the inflation.}^{49}$$

Insertion of our values and a few steps of rearrangement yield a nominal WACC of 20.4%. Just as for the Swedish companies, the Herfindahl Index is 1.0 for the Australian companies.

⁴⁹ Berk and DeMarzo (2007) p. 132

Table 5: Australia			
Company	Method	Discount rate	Comments
Gunns	DCF	9.00%	
Wilmott Forests	DCF	13.50%	Current timber prices
Timber coporation	DCF	17.50% (real) 20.40% (nominal)	WACC reported in real terms
<i>Source: Annual reports</i>			

The three Finnish companies included in our study are Metsäliitto Group, Stora Enso and UPM Kymmene. Once again the same measurement method is used, and once it again it is the discounted cash flow method. Only UPM Kymmene disclose the WACC used, which is 7.50%, and that another measurement method is used for young seedlings. For these trees, replanting cost, more or less equivalent to historical cost is used. We believe such a practice is common, but it is unfortunately not disclosed in most cases. Since the primary measurement method is the same, the Herfindahl Index for the Finnish companies is 1.0.

Table 6: Finland			
Company	Method	Discount rate	Comments
Metsäliitto Group	DCF	-	
Stora Enso	DCF	-	
UPM KYMMENE	DCF	7.50%	Young seedlings valued at replanting cost
<i>Source: Annual reports</i>			

Four South African companies are included: Mondi, Sappi, South African Forest Company, and York Timbers. Here, the measurement methods differ within the country. Mondi, Sappi and York Timbers measure their forest assets using a selling price method, while South African Forest Company use a discounted cash flow measurement method. For trees less than four years old, York Timbers use historical cost. Sappi too use historical cost for immature trees, with age thresholds of five and ten years for softwood and hardwood respectively. Seeing how this is the first country with companies using different measurement methods, this is also the first country with a Herfindahl Index lower than 1.0. More specifically, the H-Index for the South African companies in our sample is 0.625.

Table 7: South Africa			
Company	Method	Discount rate	Comments
Mondi	Selling price	-	
Sappi	Selling price	-	Immature trees valued at historical cost
South African Forestry Company (SAFCOL)	DCF	-	
York Timbers	Selling price	-	Immature trees valued at historical cost
<i>Source: Annual reports</i>			

Norway, Switzerland, Portugal and Hong Kong, representing the remaining legal origins in our sample, are represented by a single company each. These are Norske Skog, Precious Woods, Altri and China Forest Industry. Norske Skog employs a measurement method based on selling price, while Precious Woods and China Forest Industry use a discounted cash flow model. The latter use a WACC of 8%, and also measure some of its forest at historical cost. Precious Woods too use this approach, due to owning large areas of natural forests comprised of tree species with no market value.

Altri measures all of its forest assets at historical cost. As the only company in the sample doing this, we find their rationale interesting. They motivate their choice through explaining how the assumptions necessary for the computation of fair value cannot be accurately determined, and that, unspecified, indicators suggest that the historical cost of their forest assets may be close to its fair value.

Since these companies hail from different countries and do not represent a homogenous group, no Herfindahl Index can be reasonably calculated.

Table 8: Other Countries			
Company	Method	Discount rate	Comments
China Forest Industry	DCF	8.00%	Historical cost for parts of the forest assets
Norske Skog	Selling price	-	
Altri	Historical Cost	-	
Precious Woods	DCF	-	Historical cost for natural forests without accessible market price
<i>Source: Annual reports</i>			

7.2 Across countries

For the entire sample of 19 companies then, we have four companies measuring the value of their forests at selling price, 14 companies using a discounted cash flow valuation model, and one company using historical cost. In relative terms, this would be 21.05%, 73.68% and 5.26% respectively. Calculating a Herfindahl Index for all companies, ignoring national borders, gives a result of 0.59. The, for international comparison more relevant, I-index lands on 0.00.

We also calculated the relative change in value per hectare between the fiscal years 2008 and 2007 for the companies where sufficient information was available. The results of this ratio were wildly varying. For the four Swedish companies disclosing enough information to calculate the ratio, the relative change ranged from 0.45% to 3.37%. The two South African companies for whom the ratio was calculated, Mondi and Sappi, presented a relative change of -22.10% and 4.31% respectively. The company for which the relative change was the greatest was Swiss Precious Woods, whose value per hectare decreased by a substantial 25.51%.

Table 9: Value per hectare						
Company	Origin	Currency	2007	2008	Absolute change	Relative change
Wilmott Forests	Australia	AUD	6 940	7 773	833	12,00%
UPM KYMMENE	Finland	EUR	1 095	1 133	38	3,47%
Mondi	South Africa	EUR	118	92	-26	-22,10%
Sappi	South Africa	USD	1 555	1 622	67	4,31%
Bergvik Skog	Sweden	SEK	15 087	15 294	207	1,37%
Holmen	Sweden	SEK	10 678	10 726	48	0,45%
SCA	Sweden	SEK	11 953	12 356	403	3,37%
Svea Skog	Sweden	SEK	8 058	8 122	64	0,80%
Precious Woods	Switzerland	USD	11 030	8 216	-2 814	-25,51%
<i>Source: Annual reports</i>						

Table 10: Biological Assets Valuation Methods				
Country	DCF	SP	HC	H-Index
Australia	3 (100 %)	0 (0 %)	0 (0 %)	1,00
Finland	3 (100 %)	0 (0 %)	0 (0 %)	1,00
Hong Kong	1 (100 %)	0 (0 %)	0 (0 %)	1,00
Norway	0 (0 %)	1 (100 %)	0 (0 %)	1,00
Portugal	0 (0 %)	0 (0 %)	1 (100 %)	1,00
South Africa	1 (25 %)	3 (75 %)	0 (0 %)	0,63
Sweden	5 (100 %)	0 (0 %)	0 (0 %)	1,00
Switzerland	1 (100 %)	0 (0 %)	0 (0 %)	1,00
Total	74%	21%	5%	0,59
<i>Source: Annual reports</i>				

8 Discussion of Results

The empirical data presented above seems to indicate three distinct, yet very much interconnected, facts related to the degree of harmony of the measurement methods used to value forest assets. First, there is generally a substantial degree of harmony within countries, in most cases even beyond harmony and in a state of uniformity. Second, there is a good degree of harmony if national borders are disregarded and all companies are treated as part of the same set. Third however, from the perspective assumed when using the I-index, there is little harmony, even complete diversity, between countries. Below we will further discuss the details and implications of these insights, as well as explore the possible causes.

8.1 Degree of Harmony within Countries

The first insight then, of the virtual uniformity of the measurement methods used within countries, is proved by the Herfindahl Index of 1.00 for Sweden, Australia and Finland, and 0.625 for South Africa. These four legal origins, which are the ones represented by more than one company in the sample and hence the legal origins for which we can calculate a separate Herfindahl Index, all have an inherent propensity for the forest industry. The four share the characteristic of being relatively sparsely populated and, while the prevailing climates are very different, are suitable for growing forests. Therefore, one can assume that the forest industry has existed for quite some time, and that its age and traditional strength in the particular country has entrenched either a consensus on how to measure the value of forest assets or a set of relationships between the companies within a country which lead to convergence around the perceived best-practice. Other cultural factors may lead to the same result. Such possible factors include (but are naturally not limited to) sentiments of national unity, the degree of conservatism among accountants, and the historic strength of legal institutions. The purpose of this paper is not to hypothesize around issues for which we have no backing data, so we will settle for a short list of mere possibilities.

Among those companies stemming from a legal origin other than the four mentioned in the above paragraph, Portuguese Altri stands out. It is remarkable through being the only company in the sample using historical cost as their basis for measurement. Since they are the only company from Portugal, we cannot deduce any deeper insights into the Portuguese accounting practices or extrapolate any judgment onto other companies based on this, but it is nonetheless

interesting that they claim to be unable to reliably measure the value of their forest while their European peers are able to do the same. On the other hand, as mentioned by Fantl and several other scholars, this difference in measurement method may stem from difference in circumstances, making harmony and uniformity of accounting method superfluous and possibly counterproductive. After all, they do have a very fair point in their implicit dismissal of the selling price and discounted cash flow methods, and their measurement method of choice is actually allowed under IAS 41 (if only as a method of last resort). If anything, Altri's divergence shows and highlights that there are problems inherent in measuring the value of forest assets, and the acceptance of using historical cost for this purpose indicates that the IASB are well aware of these problems.

8.2 Degree of Harmony Irrespective of Legal Origin

Insight number two, that there seems to be a good degree of harmony if all companies are considered as a single set and national borders are not taken into account, is too supported by the Herfindahl Index. In this case, the value is 0.59. Since the sample is not unmanageably large, this is also evident from a quick glance at the fraction of companies using each method. A measurement method based on discounted cash flows is used by almost 75% of companies, making it the clear and obvious method of choice among the forest companies in our sample.

Why then, is an approach based on discounted cash flows preferred over a measurement method based on current market value? One reasonable assumption is that this fact indicates a lack of ready markets from which to glean the information necessary to measure forest value as the market based selling price of such forests. Companies with a business model revolving around owning forests tend to have forest holdings far in excess of what existing markets could handle. In essence, while such large forest holdings are occasionally traded (although plausibly most often through a merger or acquisition of an entire company), there exist no liquid market from which to extract the necessary information. Extrapolating from the prices of smaller forest holdings would probably not be suitable either. However, with all that said, this paper does not deal explicitly with the fundamental mechanisms of the markets for standing forest, so we need to be very careful not to draw any conclusions based mere plausibility without having collected the appropriate data.

8.3 Degree of Harmony between Countries

The third insight mentioned in the introduction paragraph of this section is the total diversity between countries. This powerful statement is derived from the result of the I-index for which we received a value of 0.00. The main reason for this is that what is actually compared when using the I-index are the countries – the companies are only a subset of the countries – and when one or more country do not use a certain accounting method that another does, the degree of harmony always equals zero for the part of the I-index calculation dealing with that particular accounting method. With non-existent harmony, as indicated by the I-index, put in relation to the spread of accounting methods in absolute numbers from the sample, it is intuitively hard to rationalize the I-index's result. In other words, the fact that the I-index gives a value of 0.00 may be difficult to accept given that for example Sweden, Australia and Finland all converge to using the discounted cash flow method. Therefore, in this case, the validity of the I-index could perhaps be questioned. However, in accordance with how the I-index is constructed, our findings are correct, but given that the companies in one country report in accordance with one single method, and that other methods as a natural consequence remain unused, the mathematical makeup of the I-index produce this rather intriguing result.

IAS 41 itself might be called a unique standard, but what makes our sample relatively small is the number of companies that are affected by the standard. In our case this leads to, when using indices, that the uniformity within countries being higher than for an industry with more players. It is a fair assumption that when IAS 41 is adopted in an even larger scale, and the permitted measurement alternatives follow as well, the I-index might provide a better measurement than it does today. This since the probability of a bigger spread amongst valuation methods across companies (which is the subset to countries) should increase with a larger number of companies.

Also, in defense of the I-index, Van der Tas touches upon that increased formal (de jure) harmonization may actually have led to decreased material (de facto) harmony. This argument is not far-fetched since the implementation of IAS 41 consequently has allowed for a greater number of options when valuing biological assets than pre IAS 41. This argument is in our case of most relevance since that earlier in Europe the valuation of standing forest was part of items such as “land” or “forest land” in the balance sheet. The accounting method used then was

typically historical cost and the accompanied accounting standards. Australia has historically had a more close relation with fair value through AASB 1037.

8.4 The Change in Value per Hectare

As discussed under 4. *Measuring Value*, the measurement methods we have dubbed discounted free cash flow and selling price both fall under the broad category of measurements methods characterized by their dependence on potentially volatile market information. It follows then, that companies measuring their assets at fair value, either through using a discounted cash flow or selling price approach, should experience more volatility in the ratio of value per hectare than a company employing a measurement method based on historical cost. As such, it is not a far stretch to interpret the change in value per hectare as evidence that fair value is being used. On the other hand, the ratio may also change in case of unexpected events such as forest fires or other dramatic and unforeseeable situations.

Another way of interpreting the ratio is to look at the assumptions underlying the measurement method used. For example, the Swedish companies have a relatively low spread, ranging from 0.45% to 3.37%. This might indicate conservative assumptions, perhaps having the price component of their discounted cash flow valuation equal an average of historical price levels or close to the expected inflation rate. More noticeable changes in value per hectare between 2007 and 2008, such as Precious Woods' negative 25.51% may indicate a significant revision of assumptions caused by any number of reasons.

For the conspiratorially inclined, the fact that both selling price and discounted cash flow methods are based, to a lesser or greater degree, on assumptions makes them vulnerable to manipulation by a less than scrupulous company management. Since changes in fair value are generally recognized as a profit or loss, and the assumptions rarely get disclosed, means that the value of biological assets may be used to dress up the company accounts as company management sees fit. Significant changes in the ratio value per hectare, without a corresponding macro event, in the absence of any dramatic changes to the owned forests, and without any clear pattern from year to year may indicate manipulation. Further analysis of this situation, beyond recognizing that the possibility exists as we do here, would require far more substantial empirical data.

Overall however, the ratio is unfortunately of little use in an analysis connected to the purpose of this paper, seeing how so few of the companies in our sample disclosed the information necessary for us to calculate the ratio. With more data, the changes in value per hectare could be compared to macro factors, such as the price of timber, and further conclusions could then possibly be drawn should that be in the interest of the researcher. What may be deduced from the ratio, although only indirectly related to what it portrays, is that despite the simple and fundamental nature of the information comprising the ratio, very few of the companies in our sample were able to communicate it effectively.

9 Concluding Remarks

The problem under investigation in this paper is: how does the measurement of the value of forest assets in accordance with IAS 41 differ among forest owning companies? With this in mind, we have collected empirical data mainly on the measurement method used by forest companies. These measurement methods, divided into selling price, discounted cash flow and historical cost, are then used to quantify the degree of harmony.

This quantification is done in three ways. First, we calculate a Herfindahl Index for those companies stemming from the same country, and clearly see that the degree of harmony is very high, in several cases even at the point of total uniformity. Second, we calculate a Herfindahl Index for all companies in the sample, irrespective of their legal origin. This too shows a significant degree of harmony, if not nearly as high as within the countries. Third, we use the I-index to find the degree of harmony between countries. Here, the index indicates that there is no harmony, i.e. total diversity, between countries. This however, does not mean that no companies from different countries share measurement method for forest assets, but rather that the forest companies of some countries have clustered around different measurement methods compared to the forest companies of other countries. The indication of total diversity is a result of the mathematical formula underlying the I-index, and the result suggests that the I-index may be less than optimal for a sample of our size.

The most obvious improvement of our study would be to use more refined methods. For example, a more sophisticated statistical study comparing the observed usage of measurement

methods with a random, or other, distribution of usage and a test for significance using chi-square, might be more intuitive. For all the merits of indices, including simplicity of use, it is somewhat difficult to know whether a particular value of an index indicates much harmony or little. Of course, a value of 1.00 or 0.00 clearly indicates total uniformity or complete diversity, but for those falling in between the implication of any value is not immediately clear. The choice of indices to use may also be questioned. Both the Herfindahl Index and the I-index have been developed further for more specialized purposes, and it is possible another index might have been more suitable.

Also, due to the aforementioned nature of indices, a study over a period of time could provide more comprehensive results. As is, we have measured harmony, while such a study would measure the process of harmonization. This would circumvent the shortcomings of values for indices being hard to interpret.

Such a study over time may also serve to illuminate what causes the degree of harmony to be as it is today, and may answer the question as to why national harmony seems to be very high among forest companies today. To gain further insights into the rationale behind the choices of measurement methods, a deeper study involving interviews with key personnel would probably be a good way forward.

Lastly, a cynical remark: despite the, in theory, improved communication to users of financial data that is said to be the effect of harmonization, many forest companies seem unable to communicate both the fundamental information related to forest assets, such as the value and the volume of the owned trees, and the assumptions and calculations underlying the fundamentals.

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