Chapter 9 Representational measurement and the presentation of accounting information in financial statements

9.1 Introduction

In chapter 1 the point was made that accounting researchers have not yet succeeded in creating a theory of accounting measurement from the analysis of financial statements. In chapters 2, 3, 4, 5, 6, 7 and 8 the investigation focused on whether the qualities of accounting phenomena that accountants currently claim to be measuring are in harmony with the principles of representational measurement: it was established that they are not. These findings indicate that the current immeasurability of accounting phenomena is one of the causes of the lack of success researchers have had in creating a theory of accounting measurement from accounting practices. The accounting literature (e.g., IASB, 2006; Wolk *et al*., 2001) also prescribes ways in which accounting information should be presented in financial statements. These methods of presenting information have not yet been analyzed in this study in order to determine whether they are in harmony with the principles of representational measurement.

According to IAS1 (2006), a complete set of financial statements shall comprise a balance sheet, an income statement, a statement of changes in equity, a cash flow statement and the notes to the financial statements. The IASB framework (2006) for financial reporting prescribes the format in which accounting information should be presented in the balance sheet, income statement, statement of changes in equity and the cash flow statement. The purpose of this chapter is to examine whether accounting information is presented in a way that is in harmony with the principles of the representational theory of measurement.

In section 9.2 the compatibility of the structure and content of the balance sheet with the principles of representational measurement is discussed. The compatibility of the structure and content of the income statement with

representational measurement is discussed in section 9.3. Criticisms of the harmony between the contents of the statement of changes in equity and representational measurement are highlighted in section 9.4, followed in section 9.5 by a discussion of whether the cash flow statement depicts a process of measuring the cash movement in a business entity.

Section 9.6 focuses on the implications the concept of time has for the applicability of the representational theory of measurement to the income statement and balance sheet. In section 9.7 the merits of the concept of classification as a form of measurement in financial statements is discussed. The implications of the representational theory of measurement on performance measurement are explored in section 9.8. Included in this section are a discussion of the implications of representational measurement for earnings per share as a measure of performance, the concept of economic value added and the accounting concept of ratio analysis. Section 9.9 presents the conclusion.

9.2 The compatibility of the balance sheet with representational measurement

Research into the merits of the structure and content of financial statements is not a new idea. Several authors have criticized the structure and content of the balance. Fitzgerald (1936: 74) argues that the balance sheet fails to portray useful information to users of financial statements: users cannot rely on the contents of the financial statements in making economic decisions. Consequently, the balance sheet has failed in its role as a source of information for users. Lev (1974) also highlights the point that financial statement analysis is rather a futile exercise, suggesting that financial analysts are not able to establish the underlying relationships that the information in the financial statements wishes to convey. Consequently, it can be argued that financial statements are not a true reflection of the economic activities of an entity. Miller and Bahnson (2002:50) assert that users of financial statements have come to the realization that they cannot rely on the information these present in making economic decisions. Financial statements

have lost credibility as a source of information in decision making. This suggests that financial statements are not defensible by users as a source of financial information.

The IASB framework for financial reporting (2006, Para 99) asserts that the information presented in financial statements reflects measurement information about the values of their elements. This assertion cultivates the expectation that the monetary units presented in financial statements are in harmony with the principles of measurement. Since all measurement information is assumed to be objective (Luce *et al*., 1971), it is to be expected that information in financial statements is an objective representation of the economic activities of an entity. But the inability of the financial statement to provide reliable information about the economic activities of a business entity suggests that this information is not measurement information about an entity's economic activities. It is necessary to analyze some of the principles employed in the preparation of financial statements to evaluate whether these principles are in harmony with the principles of the representational theory of measurement. The employment of the principles of measurement in the preparation of financial statements is evident. For instance, Paragraph 53 (IAS 1, 2006) states:

> When an entity supplies goods or services within a clearly identifiable operating cycle, separate classification of current and non current assets and liabilities on the face of the balance sheet provides useful information by distinguishing the net assets that are continuously circulating as working capital from those used in the entity's long term operations.

This paragraph highlights the fact that assets should be differentiated into current assets and non-current assets. Mattessich (1964) points out that classification is a form of measurement. This indicates that the discrimination of assets into current and non-current assets is in harmony with the principles of the representational theory of measurement. According to Stevens (1951), before such discrimination can occur, representational measurement requires the specification of the

attribute that is used to classify assets as such. There is thus an attribute that is used to distinguish current assets from non-current assets. Without such specification the classification of assets does not reflect compatibility with the principles of representational measurement. Chambers (1997) notes that there are no specified attributes for use in classifying assets as current or non-current. If this is the case, it would be helpful to present assets to users in isolation. Grouping them into current assets and non-current assets implies that there is some common attribute among them when in fact such an attribute cannot be specified. Consequently, this discrimination misinforms users. Unless an attribute or a criterion that can be empirically verified is provided, such a grouping is not a valid form of measurement under the representational theory of measurement.

In chapter 4, it was noted that the concept of the ordinal scale requires that the attribute that induces order among elements in a set be specified. At present, in financial statements, current assets and current liabilities are presented in the balance sheet in a hierarchy in accordance with their liquidity. This kind of hierarchy reflects an attempt by the accounting discipline to use the ordinal scale. This is reflected by Paragraph 54 (IAS 1, 2006) as follows:

> For some entities, such as financial institutions, a presentation of assets and liabilities in increasing or decreasing order of liquidity provides information that is reliable and is more relevant than a current / non current presentation because the entity does not supply goods or services within a clearly identifiable operating cycle.

This paragraph points out that current assets and current liabilities should be presented in the balance sheet in order of increasing or decreasing liquidity. This is an implication that an ordinal scale was used during such a classification. Since all scales of measurement require the specification of an attribute that is being measured (Stevens, 1951), this suggests that there is a property that is used to order current assets or current liabilities according to how liquid they are. However, this discrimination process will fall short of the principles of the

representational theory of measurement unless a measurable attribute which can be used in the ordering of current assets or current liabilities according to liquidity is specified. This is because in the accounting discipline there is no clear definition of the attributes that can be used to measure the liquidity of assets or liabilities. The absence of precisely defined attributes of measurement that might be used to measure the liquidity of an asset or a liability implies that the discrimination of assets or liabilities into a hierarchy according to their liquidity is not in harmony the principles of representational measurement.

According to Paragraph 58 (IAS 1, 2006), the term ”non-current assets” should include tangible, intangible and financial assets of a long-term nature. In other words, intangible assets fall under the same classification as tangible assets. Stevens (1951) points out that classification is a form of measurement. This suggests that there are attributes that are common to both tangible and intangible assets. Currently, however, there are no specified attributes common to both tangible and intangible assets that would allow them to fall into the same class.

The concept of an intangible asset in the accounting discipline does not help the cause of measurement in the presentation of accounting information. Intangible assets are not real (IAS 38, 2006: Para 9). As a result, their presence cannot be empirically verified. The attributes that describe the empirical properties of intangible assets are thus not empirically testable. According to Decoene *et al.* (1995), magnitudes are historically and theoretically determined reflections of quantitative aspects of objectively existing entities, and not merely the outcome of metricization or measuring procedures. This indicates that all phenomena that are measured must exist and they must be objective. Intangible assets cannot be put into the same class as tangible assets as they do not exist: before this can happen, the attribute that is used to classify them should be specified and must be empirically testable. Currently, there is no specification of such an attribute. As a result, such a classification is meaningless in the measurement sense.

In the balance sheet, the monetary amounts used to reflect the value of an asset or a liability are aggregated to other balances in the same class. However, such an aggregation must be in agreement with the principles of the representational theory of measurement for it to make measurement sense. Paragraph IG4 (IAS 1, 2006) points out that a total of the monetary values of items classified under a particular heading (e.g., the sum of the values of current assets and the total assets) should be given in the balance sheet. But, it is inappropriate to sum, say, the value of property plant and equipment and the value of intangible assets. These two quantifications represent completely different properties. In chapter 6 it was established that value is an ambiguous concept and not an intrinsic property of an accounting entity. This suggests that the attributes of value are also ambiguous, and as a result they cannot be empirically tested. Furthermore, Ryan *et al*. (2002:118) also point out that there is no agreement relating the amount of monetary units paid to acquire a commodity and its value. This means that monetary units are arbitrarily assigned to the value of an element of a financial statement. It can also be inferred that the concept of value used in the assignment of monetary units to the value of a particular asset could be different from the concept used to assign it to another. This would make the two views of value used structurally different and as a result the monetary units assigned to intangible assets should not be added to those assigned to property plant and equipment. Such an addition can only take place if the two measurements can be shown to be structurally identical.

The homogeneity law of the representational theory of measurement must be taken into account before aggregating measurements. From Luce's (1996) point of view, homogeneity means that elements cannot be distinguished structurally one from another. It is a major feature of those extensive structures that have a representation onto the real numbers. Measures of different elements should be added together only if they are structurally homogeneous. But, in the case of the assets mentioned above, it is not possible to prove the homogeneity law among different numerical assignments to the value of assets, as value is an ambiguous

concept. The view that value is ambiguous suggests that value is currently not known with certainty in accounting. Furthermore, with regard to liabilities, the mathematical operation of addition should not be performed on the quantifications that describe the properties of liabilities unless the scales of measurement and the attributes that are being measured are specified and shown to be structurally identical. Only measurements that have been made on an identical scale are structurally identical. There is currently no proof that different numerical assignments in accounting are identical. This discussion points out that the accounting information in financial statements is presented in a way that is not consistent with the principles of the representational theory of measurement.

9.3 The compatibility of the income statement with representational measurement

The merits of the income statement as a presentation of information about the measurement of the income of a business entity have been criticized in the accounting literature. Fitzgerald and Fitzgerald (1947:217) argue that depreciation should not be included in the income statement, as it cannot be matched with income. This view suggests that income and depreciation are phenomena that do not belong to the same class. It follows that the attributes of income and the attributes of depreciation cannot be matched in the calculation of periodic income. Stamp (1981) claims that the income of a business entity cannot be measured. He argues that there is no precise definition of income. This implies that income cannot be empirically tested. It follows that the items in the income statement that are used in the determination of income also do not have a precise definition.

The concept of addition and subtraction is fundamental to the concept of the income statement. IAS 1(2006: 81) points out that those items of income in the income statement should be added to each other, while items of expense should be added to each other. This means that an identical attribute is being measured for different items of income. The paragraph (IAS1, 2006 Para 81) requires that the total of expenses should be subtracted from the total of the items of income to

determine the profit or loss for that period. The attribute of expenses that has been measured is thus identical to the attribute of income.

The operations of addition and subtraction can only be conducted on measurements if the individual measurements can be shown to be structurally identical. This means that the addition of measurements can only be done when these measurements have been made on an identical scale. Willet (1987) notes that specified scales for measuring the attributes of accounting phenomena do not exist in accounting. This suggests that there are no scales for measuring the attributes of expenses in accounting. It is therefore inappropriate to add the amounts of the different items of expenses, or the amounts representing different items of income, to each other as these individual measurements have not been shown to be structurally identical. The conditions of addition have not been specified. It is necessary to specify the attribute that is being measured and the scale that has been used to measure it (e.g., the measurement of height in metrers). Such a specification ensures that the measurements being added are not structurally different. The same goes for the addition of amounts of monetary units representing the values of income. It is necessary to ensure that the attributes that are being measured do not differ structurally from each other. Luce (1996) points out that addition is only possible if the elements cannot be distinguished structurally one from another. In this case it is not clear whether the values of the elements being added and subtracted are structurally different. It must be shown that the measurements of attributes of different expenses are identical before addition can take place.

It is also not clear whether the monetary units in the income statement are measures of anything. Accounting research (Ryan et al., 2002; Willet, 1987) indicates that it is not known exactly what monetary units in accounting represent. This means that the empirical relational structure that is being represented by monetary units in the income statement is unknown. In every measurement space it is necessary that the attributes that are of use and interest to measure are

specified (Luce *et al*., 1971). As a result, it can be concluded that the concept of adding and subtracting items of income and expenses to or from each other without the specification of the attributes whose magnitudes are being added requires that these attributes and the scale of measurement be specified.

9.4 The compatibility of the statement of changes in equity with representation measurement

The purpose of a statement of changes in equity is to reflect the increase or the decrease in the net assets during two balance sheet dates. According to IAS1 (2006), this reflects the movements in an entity's capital during an accounting period. The presentation of financial information in the statement of changes in equity also reflects the lack of harmony between the principles of the representational theory of measurement and the statement of changes in equity. IAS1 (2006, Para 96) points out that the profit and loss for the period should be added to each item of income and expense for the period that is recognized directly in equity. This indicates that the monetary units representing the various components (profit, income, expenses, etc.) should be added and subtracted in the determination of the value of equity at the end of the period. This is an addition of monetary units representing attributes that are not known to be structurally identical. Chambers (1997) notes that there are no specified attributes in the accounting discipline that are of use and interest to measure. The attributes of accounting phenomena that are represented by the amount of monetary units in the financial statements are thus also not known. As a result, there is a possibility in the statement of changes in equity of adding to each other measures of attributes that are structurally different.

As pointed out above (IAS1, 2006), the purpose of the statement of changes in equity is to show the increase or decrease in equity between two balance sheet dates. The statement of changes in equity is thus a statement that reflects a process of calculating the net changes in equity between two balance sheet dates. It is arguable whether this process can be regarded as a process of

measurement. According to Sterling (1979), the purpose of measurement is to determine the magnitude at that specific point in time regardless of what has happened before or what will happen afterwards. He argues that what has gone before is a separate process known as history, and what will come after is a separate process known as forecasting: it is an error to confuse measurement with history or with forecasts. This point of view suggests that it is an error to try and produce a measure by comparing measurements made at different points in time. This means that the net increase or decrease in equity that is a result of comparing two values of equity at two different balance sheet dates cannot be considered to be a measure. The values of equity have been produced under different conditions and as a result they cannot be considered as structurally identical. According to Luce *et al*. (1971), measurements should only be added or subtracted if they have been made under identical conditions. Therefore, the net increase in equity between two balance sheet dates cannot be considered to be a measurement.

9.5 The compatibility of the cash flow statement with representational measurement

The cash flow statement is used to establish the financial health of a company. Sterling (1979) points out that the information in the cash flow statement is more reliable than that in the income statement. He argues that the cash flow statement adjusts the income statement by adding back allocations such as depreciation. Allocations do not reflect the actual movement of cash in a business, but are merely a simulation of what is expected to happen to an asset during its use in the business. An expectation does not represent an actual event. An expectation might or might not happen. But cash flows represent actual happenings. As a result, cash flows are preferable to income.

Measurement in the cash flow statement can be viewed from the perspective of measuring the net movement in monetary units during an accounting period. This perspective focuses on the representation of monetary units by natural numbers.

That is, the attribute that is being measured is the unit of money, the abstract structure is the natural numbers and the unit of measurement is the currency. In this case, monetary units are not taken to be a measure of value. It is the monetary units that are being represented by the natural numbers. In the cash flow statement, under these circumstances, it would be possible that cash generated by operations can be added or subtracted meaningfully to cash flows from investing activities and cash flows from financing activities. This is because the measurements of the three cash flows are structurally identical. They would be representing the measurement of an identical attribute (the unit of money).

However, if the concept of measurement in the cash flow statement is viewed from the perspective that monetary units in the financial statements are a representation of the value of the elements of these financial statements, then the principles of the cash flow statement are not in harmony with the principles of the representational theory of measurement. 1AS 7(2006) requires the specification of the cash generated by operations. To arrive at this, cash paid to suppliers and employees is subtracted from cash receipts from customers. Subtracting cash paid to suppliers and employees from the cash received from customers implies that these two amounts of monetary units represent an identical attribute. The attribute that is represented by cash received from customers is not known. Furthermore, the attribute that is represented by cash paid to suppliers and employees is not known either. The homogeneity law outlines that measures should not be added to each other unless if they are structurally identical (Luce *et al*., 1971). If the attributes that are represented by the monetary units are unknown, it is impossible to determine whether the homogeneity law can be satisfied. Therefore, the subtraction of cash paid to suppliers and employees from cash received from customers could lead to the subtraction of measures that are not homogeneous.

Willet (1987) points out that there is no agreement relating the amount of monetary units to the concept of value. This means that the scale of measuring value using monetary units in unknown in the accounting discipline. It follows that

it cannot be verified whether different amounts of monetary units represent value that has been measured on an identical scale. This suggests that cash received from customers is structurally different from the cash paid to suppliers and employees. Aggregations of quantities that are structurally different from each other should not be made. Before aggregations are done, assurance should be obtained that the items that are being aggregated are not structurally different. This requires the specification of the attributes whose measurements are being aggregated and the scales of measurement used to assign numbers to them; otherwise it will not be possible to effect addition or subtraction in the cash flow statement. It must be clear that the amounts being added have been measured on an identical scale.

9.6 Representational measurement and the concept of time in the income statement and balance sheet

In this section the implications of the concept of time in the income statement and balance sheet are discussed. The discussion that follows highlights the fact that the effects of the concept of time on representational measurement are not taken into account in preparing the income statement and balance. As a result, the concept of periodic financial statements is not in harmony with the principles of representational measurement. Paragraph 49, (IAS 1, 2006) highlights the concept of periodic financial statements:

> Financial statements shall be presented at least annually. When an entity's balance sheet date changes and the annual financial statements are presented for a period longer or shorter than one year, an entity shall disclose, in addition to the period covered by the financial statements: The reason for using a longer or shorter period; and the fact that comparative amounts for the income statement, statement of changes in equity, cash flow statement and related notes are not entirely comparable.

This paragraph notes that financial statements should be prepared on a periodic basis. This means that financial reporting divides the life of a business into different segments. Business activities are then assigned to a specific segment. Goldberg (2001) states that economic events flow into a business throughout its life. This suggests that there is no stop to business activities until the end of its life. It can also be inferred that accounting activities have to be stopped at the end of each reporting period so that economic performance and the financial position can be determined. This kind of stoppage is arbitrary and never actually happens in practice as long as the business is still considered a going concern. A true stoppage of business activities only occurs at liquidation. In other words, periodic financial statements are not a reflection of reality in a business.

Sterling (1968) believes that all financial statements prepared under the going concern concept are provisional and it requires liquidation for true statements to be prepared. He also argues that periodic financial statements are dependent on subsequent events. This view suggests that financial statements can only be empirically verified at liquidation. In chapter 2 it was noted that only real world phenomena can be measured. Therefore, if the truth of the information contained in financial statements is dependent on subsequent events, it is not possible to measure the attributes of accounting phenomena when the business is still a going concern, as these attributes cannot be established objectively.

The use of the accrual concept in the preparation of financial statements is also not in harmony with the principles of the representational theory of measurement. The requirement to use the accrual concept in preparing financial statements under the going concern concept is expressly stated in the accounting literature. Paragraph 25 (IAS 1, March 2004) states it as follows:

> An entity shall prepare its financial statements, except for cash flow information, using the accrual basis of accounting.

Accrual accounting is mainly concerned with future cash receipts and payments. The only measurements that can be made about the future are expectations. If accounting information prepared under the accrual concept is considered to be

measurement information, then the accrual concept implies that it is possible to measure the future. As outlined earlier (Orbach, 1978), only expectations of future phenomena have legitimate properties that are measurable in the present. It follows that it is only expectations of future economic phenomena that have properties that are measurable under the accrual concept. This does not include the assignment of numbers to future phenomena. Decoene *et al*. (1995) also point out that one of the defining features of the representational theory of measurement is the belief that questions of measurement must be grounded in how reality is structured. In other words, there is no way of posing the question of measurement of a variable prior to an understanding of the structure of that variable. Thus, it is not possible to measure the attributes of phenomena that are in the future, except expectations. Only expectations of future economic phenomena are measurable under the accrual concept.

The income statement also reflects the performance of a business entity over a particular time period. According to Sterling (1979), all measurements are made at a specific point in time. He argues that the purpose of a measurement is to discover the magnitude at that point in time without regard to what has gone before or what will come after that point. Therefore, it can be argued that it is inappropriate to aggregate quantifications of accounting phenomena made at different points in time. It can also be inferred that changes in time create changes in the conditions of measurement and, as a result, the measurements produced are different and incomparable. It also follows that accounting quantifications that meet the criteria of measurements should be classified in accordance with their dates of creation. It is therefore necessary to adjust for the different conditions under which the quantifications have been made before these quantifications can be added or subtracted.

The balance sheet reflects a particular point in time. If as outlined earlier (Sterling 1979), measurements are made at a specific point in time. The balance sheet should contain accounting measurements that are specific to the balance sheet date. All accounting measurements should have been made at that specific

balance sheet date. Currently, however, the balance sheet includes quantifications of accounting phenomena that have been made at different points in time. Whether these quantifications meet the criteria of measurements still has to be verified. Before such quantifications can appear and be added to each other in the same balance sheet, adjustments for the different conditions under which the quantifications have been produced must be made to verify whether these quantifications are indeed measurements.

9.7 Representational measurement and the concept of classification in financial statements

In chapter 4 it was noted that classification is the basis of all measurement. It was also established (Mattessich, 1964:61) that classification forms the basis for the establishment of the nominal scale and other higher-ranking scales (see chapter 4) such as the ordinal, interval and ratio scales. This indicates that no measurement can occur without classification. The discussion in this section focuses on whether the use of the concept of classification in the preparation of the income statement and balance sheet is in harmony with the principles of the representational theory of measurement. The concept of classification plays a fundamental role in accounting, so much so that it is reflected in the definition of accounting. Kam (1990:33) highlights it as follows:

> Accounting is the art of recording, classifying and summarizing, in a significant manner and in terms of money, transactions and events which are, in part at least, of a financial character, and interpreting the result thereof.

This passage indicates that classification forms part of the foundation of accounting. Consequently, it follows that if classification is a form of measurement (Mattessich, 1964: 58), measurement forms part of the foundation of accounting. The passage also points out that classification is also made in terms of money. The unit of measurement in accounting is money (e.g., dollars, rands, etc.).

Therefore, unless the denomination of monetary units is specified, no classification can occur in accounting.

The concept of classification forms the basis of the preparation of financial statements. Paragraph 27 (IAS 1, 2006) puts it as follows:

> The presentation and classification of items in the financial statements shall be retained from one period to the next unless: It is apparent, following a significant change in the nature of the entity's operations or a review of its financial statements, that another presentation or classification would be more appropriate having regard to the criteria for the selection and application of accounting policies in IAS 8; or A Standard or an Interpretation requires a change in presentation.

There shall be a consistent classification of items in the financial statements from one accounting period to another unless there is a need for change. This indicates that classification is one of the foundations for the preparation of financial statements. If the classification of items in these financial statements is to be retained from one period to the next as outlined in the paragraph above, then it means that some accounting phenomena are expected to recur. It can also be inferred that identical characteristics of accounting phenomena are expected to recur each year. Classification is regarded as the most basic form of measurement, and measurement requires the specification of the attribute to be measured (Mattessich, 1964). However, there is no specification in the accounting literature of the characteristics of the properties that are used to classify accounting phenomena. In addition, there is no specification of the attributes of accounting phenomena that have recurred or that are expected to recur. Attributes that are expected to recur must be specified in order to identify them when they recur in future periods.

Moreover, the paragraph implies that a change in the nature of the entity's operations changes the attributes of accounting phenomena that are measured.

However, the accounting literature does not require the specification of the characteristics of accounting phenomena that are altered by a change in the nature of the entity's operations. This indicates that accountants are oblivious of the fact that every measurement scheme requires the specification of the property of a class of objects which it is of use and interest to measure (see, Chambers, 1997). There is thus an incompatibility between the accounting concept of measurement and the principles of the representational theory of measurement. It can be concluded therefore, that the classification of accounting phenomena in financial statements is not in harmony with the principles of representational measurement. Other inconsistencies in the accounting concept of measurement and the principles of the representational theory of measurement are reflected by Paragraph 30 (IAS 1,2006):

> Financial statements result from processing a large number of transactions or events that are aggregated into classes according to their nature or function. The final stage in the process of aggregation or classification is the presentation of condensed and classified data, which form line items on the face of the balance sheet, income statement, statement of changes in equity and cash flow statement, or in the notes. If a line item is not individually material, it is aggregated with other items either on the face of those statements or in the notes.

This paragraph highlights the point that the aggregation of the "measurements" of the attributes of the classes of accounting events is a result of the fact that business entities deal with numerous transactions. Such an aggregation is possible if the measurements being added are structurally identical. Measurements are structurally identical when they are made on an identical scale. Chambers (1997), points out that measurements taken on scales calibrated in different units may not be added without first converting them to measurements on a common scale. This means that measurements of the attributes of different accounting events should be added when it can be shown that they have been

made on an identical scale of measurement. However, there is no specification in the paragraph of the units of measurement for the attributes measured or of the attributes that are used to classify the transactions or events. Although there is mention of the need to classify transactions according to their nature and function, the representational theory of measurement requires these to be empirically testable (see, chapter 2). The attributes of expenses that represent the nature and function of expenses that can be empirically tested must be specified.

9.8 Representational measurement and performance measurement

Financial statements are considered to be a representation of an entity's performance. According to IAS1 (2006), financial statements are a structured representation of the financial performance of an entity. A brief discussion of whether some of the measures of performance that are commonly found in financial statements are in harmony with the principles of representational measurement is provided below.

9.8.1 Representational measurement and earnings per share

Earnings per share are commonly referred to as measures of performance in the income statement. The International Accounting Standard (IAS) 33(2006), deals with the determination of earnings per share. This refers to the process of determining earnings per share as a process of measurement. This reference suggests that the process of determining earnings per share is in harmony with the principles of the representational theory of measurement. According to IAS 33(2006: Para 10), basic earnings per share shall be calculated by dividing profit or loss attributable to ordinary equity holders of the parent entity (the numerator) by the weighted average number of ordinary shares outstanding (the denominator). The IAS argues that the objective of basic earnings per share is to provide a measure of the interests of each ordinary share of a parent entity in the performance of the entity over the reporting period. This indicates that earnings per share are measurements on a ratio scale. Luce *et al*. (1971) point out that all

ratios are measurements on a ratio scale. It can be inferred from this that earnings per share are regarded as a measure of the interests of each ordinary share. It also follows that the attribute that is being measured by earnings per share is the interest of each ordinary share in the profits generated by a business.

The price /earnings ratio is one of the key ratios adopted by financial analysts. Its foundations are based on earnings per share. IAS 33 (2006) defines the P/E ratio as the current market share price divided by the earnings per share. This indicates that the price earnings ratio is determined by relating measures of prices and measures of earnings per share. Mattessich (1979) points out that ratio measures are derived measurements as they are inferred through a combination of two or more fundamental measures. This means that there must be theories of measurement that relate to the fundamental measurements. There must be measurement theories in accounting that relate current market price to earnings per share. The fact that the price/ earnings ratio is referred to as a "ratio" indicates that it is a measurement on a ratio scale. Luce *et al*. (1971) note that every process of measurement must have a theory of measurement. This suggests that there must be theories of measurement for all the variables that are used in the measurement of the price earnings ratio if this ratio is to be regarded as a product of a process of measurement. That is, there must be a theory for the measurement of a price of a share and a theory for the measurement of earnings per share. Without these two theories the price/earnings ratio would not be measurable.

It is questionable, however, whether the price/earnings ratio or the earnings per share ratio can be considered measures of performance. In chapter 6 it was explained that the current market price cannot be considered a measure of anything as it does not comply with the principles of the representational theory of measurement. It was also noted that the relationship between monetary units and value is not known. This means that the rules for assigning monetary units to the value of a commodity are not known. But measurement theory requires that the assignment should be representative, that is, the predefined relationships

between the assigned numbers should be representative of the equivalent relationships that exist between the measured attributes (Mock, 1976:15). The assignment of monetary units to the value of a commodity must therefore be a homomorphism that is appropriately defined. In this case, the assignment of monetary units to value cannot be considered to be a homomorphism, as the nature of the assignment cannot be precisely defined.

Also in chapter 6, it was pointed out that income is not defined precisely in the accounting discipline. This means that the concept of income cannot be known with certainty. As a result, there cannot be a common agreement among accountants on the meaning and qualitative structure of income. Margenau (1959:165) asserts that prior to measurement, a precise theoretical construction of the attribute is necessary. It follows that first one must have a concept of some quality and looks afterward for quantitative expressions of it (Caws, 1959:8), It is therefore not possible to measure the earnings of an accounting entity unless one has a precise theoretical construction of income. The belief in the accounting discipline that it is possible to measure earnings reflects the apparent inability of this discipline to fully recognize the need to specify the domain of the measurement function. That is, it is necessary to specify those attributes of income that are measurable.

The weighted average number of ordinary shares outstanding during an accounting period is a measure of the quantity of ordinary shares outstanding during a particular period. This is a measurement on the ratio scale. The ratio character of the quantity of ordinary shares outstanding during an accounting period is based on the numerical representation of the units of ordinary shares so that the value associated with the concatenation of adjacent intervals is the sum of values associated with those intervals. In practice, this measurement is carried out by counting the number of issued share certificates during a period., It should be noted, however, that the division of current market price by the earnings per share to determine the price earnings ratio is not measurement on a ratio scale. There is no empirical relation between the current market price, earnings and the

concatenations that pertain to the measurement of the quantity of ordinary shares. Therefore, the price/earnings ratio is a hypothetical pre-theoretic variable. More research is needed in order to arrive at the empirical definition of the price/ earnings ratio.

9.8.2 Representational measurement and the concept of economic value added

Economic value added is a measure of performance that is presented in financial statements. The discussion in this section focuses on whether the concept of economic value added is in harmony with the principles of the representational theory of measurement. CIMA (2004:447) defines economic value added as follows:

> Economic value added (EVA), "A measure which approximates a company's profit. Traditional financial statements are translated into EVA statements by reversing distortions in operating performance created by accounting rules and by charging operating profit for all of the capital employed. For example, written off goodwill is capitalized, as are extraordinary losses and the present value of operating leases. Extraordinary gains reduce capital.

This definition points to the fact that accounting measures of economic value added are derived from the periodic profit of a company. However, it should be indicated that it is not possible currently to derive a measure of performance through the adjustment of profit. In chapter 6 the fact that there is no empirical definition of profit was highlighted. If profit is not an empirical concept, it can be inferred that profit cannot be validly determined. This means that profit cannot be empirically tested. Stevens (1951) contends that all measures should be capable of empirical verification. This suggests that economic value added is not currently measurable as its basic building block (income) is not measurable. It would

require the specification of the attributes of profit to make the process of determining economic value added empirical.

The passage above also highlights the notion that adjustments are made to operating profit in order to arrive at economic value added. These adjustments made to the company's profit do not have the dimensions and qualities that are measurable on well-founded scales either. Goodwill written off has been noted as one of the adjustments made to operating profit in order to arrive at economic value added. There is no specification of the attributes of goodwill that are measurable. In addition, Chambers (1997) notes that there is no specification of the property that is of use and interest to measure in accounting. This suggests that the domain of the measurement function in the measurement of the attributes of goodwill is not specified. Yet, Luce *et al*. (1971) remark that, prior to measurement, a precise theoretical construction of the attribute is necessary. It follows that the process of determining value added is not consistent with the principles of representational measurement.

In addition to the above, the process of determining economic value added is not based on reality; for example, the adjustment of written off goodwill from operating profit. According to Gouws and Van der Poll (2004), write offs are book entries. They argue that they are a creation of the mind. This means that book entries are not based on reality, and are therefore arbitrary. If this is the case, it follows that the process of determining Economic Value Added is arbitrary and it cannot therefore be considered to be a measurement process. Stevens (1951) points out that measurement is only possible when phenomena are empirical. Since economic value added is not empirical, cannot be measurable. It follows that the process of determining economic value is not a process of measurement either. All processes of measurement produce empirically testable measures.

9.8.3 Representational measurement and ratio analysis

The concept of a ratio is widely used in financial analysis. Ratios are also prominent in financial statements. A ratio describes the relationship between two groups of things that are represented by two numbers showing how much larger one group is than the other (Hornby, 2005). Ratios are a way of comparing things. If ratios are used properly they can be a source of measurement. Ratios are considered measures of performance in accounting (Bernstein, 1993). It can be inferred from this that financial ratios are scaled values of the empirical relationships between accounting phenomena. Therefore, if accounting ratios are measures of the attributes of accounting phenomena as implied by the accounting literature, then accounting ratios should be compatible with the principles of the representational theory of measurement.

According to CIMA (2004:392), ratios are a useful way of measuring performance. CIMA argues that it is easier to look at changes over time by comparing ratios from one time period with the corresponding ratios for periods in the past. This kind of comparison would require that the operating conditions between the two operating periods be identical. McLean (2006) points out that performance is always measured in relation to some point of reference, such as an objective or precedent. For performance to be comparable over two different accounting periods, then, the differences over the two operating periods must be adjusted.

Sterling (1979) notes that the notion of comparability over time means that it is possible to compare one period to another by measuring the same attribute. This means that the attribute that is of use and interest to measure that is common to both accounting periods must be specified. According to Chambers (1997), this attribute is not specified in the accounting discipline. It can be inferred from this that accounting ratios are not currently comparable over different accounting periods.

Ratios are also a way of comparing financial information from different firms. CIMA (2004) argues that ratios provide a way of summarizing an organization's results and comparing them with similar organizations. Ratios provide a standard of measurement across different business organizations. It is necessary to specify the attributes, the measures of which are comparable over different organizations. Currently, there are no specified attributes common across different entities. This indicates that accounting information is not comparable over different companies.

ACCA (2000), contends that companies are inherently different in structure and use different accounting policies. Although these may be disclosed in financial statements, it is sometimes difficult to adjust the accounts for these differing policies, as the information required to apply the adjustment may not be disclosed. In such cases it is unlikely that different companies will apply identical measurement procedures to identical accounting phenomena. Moreover, empirical tests generally support the assertion that capital investment decisions (Larcker, 1983), merger and acquisition decisions (Lewellen *et al*., 1985; Tehranian *et al*., 1987; Walking and Long, 1984) and financial accounting procedure choices (Healy, 1985) are associated with managerial compensation plans. In other words, the comparability of accounting information, especially between different companies, should be done after ensuring that like phenomena will be compared.

The comparability of accounting information is also hampered by the lack of specified characteristics that are measurable. This suggests that accounting ratios are not measurements and that they do not meet the criteria that are required of a ratio. Belkaoui (1992:27) defines a ratio as follows:

> A ratio is a measure of a specific characteristic that is obtained through laws relating the property to other properties.

This definition indicates that there must be more than one property whose relationship with others is measured by the ratio. In accounting, this includes the division of the monetary amount of one element of the financial statement by

another. An example of this is the cash ratio, which is expressed as Cash plus Cash equivalents divided by Total Current Assets (Bernstein, 1993:548). Bernstein (1993) argues that the proportion that cash and cash equivalents constitute of the total current assets group is a measure of the degree of liquidity of this group of assets. However, it is inconceivable to call this proportion a measure: there is no specification of the specific characteristic that is being measured by this ratio. That is, there is no clear identification of the aspect called the degree of liquidity that this proportion is supposed to represent. Yet every measurement scheme requires the specification of the property of a class of objects which it is of use and interest to measure (Chambers, 1997). Furthermore, there is no specification of the property that the monetary amount of cash represents. In addition, current assets are valued in terms of future economic benefits (Hemus, *et al*., 2000:9). This means that the property of current assets that is represented by the monetary amounts reflected in the financial statement lies in the future. As a result this property of current assets is not empirically decidable; the property can thus not be considered measurable.

9.9 Conclusion

The preparation and presentation of financial statements is based on the premise that accounting is a measurement discipline. Financial statements are also prepared on the premise that the figures that are used to represent the attribute of the elements of the financial statements can be freely added or subtracted. The accounting literature asserts that in this discipline the attribute that is of use and interest to measure is value. However, value is an ambiguous concept that is not an intrinsic property of an accounting entity and cannot thus be measured. In addition, there is no agreement relating the amount of monetary units paid to acquire a commodity to its value. This means that there is no agreement among accountants on the scale of measurement of value. Yet, measurement may be described as the process of identifying selected attributes of a set of objects (or events) and assigning numbers (or other mathematical entities, such as vectors) to these objects so that the properties of the attributes are preserved or represented by the assignment. This means that the numerical assignment must

be a homomorphism. Therefore, if value is an ambiguous concept, then it is not possible to have a valid numerical assignment that represents value. It follows that the numerals assigned to the attributes of the elements of financial statements cannot be validly added and subtracted, as there is a possibility that they are structurally different.

A summary of the present analysis indicates that:

- Earnings per share are not a measure of performance but an estimate of performance. There is no empirical law relating earnings to the number of shares outstanding in an accounting period.
- Income is a subjective concept that is not an intrinsic property of an accounting entity. As a result, income is not measurable. It lacks a precise definition which is a prerequisite if it is to be measured. Without a precise definition it is not possible to specify the attributes of income.

The discussion in this chapter has revealed that financial statements are not presented in a way that is consistent with the principles of the representational theory of measurement. It has also revealed that the performance measures that are incorporated in financial statements are not in harmony with the principles of the representational theory of measurement. Therefore, it can be concluded that new ways of presenting information in financial statements that are consistent with the principles of the representational theory of measurement should be devised.

Chapter 10- The meaningfulness of accounting information

10.1 Introduction

Accounting is generally referred to as a measurement discipline, the purpose of which is to produce information that is useful to users (e.g. Kirk, 2005; IASB, 2006; Staubus, 2004; Wolk, *et al*, 2001). One would expect the accounting discipline to be capable of producing measurement information. A failure to do so would imply that accounting is not a measurement discipline. Measurement literature (Luce *et al*. 1971, 1990; Narens, 2002; Stevens, 1951) reveals that all measurement information must be meaningful. If accounting is a measurement discipline, as outlined above, then accounting measurements should be meaningful. According to Luce *et al*. (1990), measurement information is meaningful if the use to which it may be put is specified. For measurement information to be meaningful, the nature of valid inferences that may be drawn from the information must be specified. Therefore, it follows that users must be aware of the type of inferences that may validly be drawn from the accounting information if this information is to be meaningful.

However, accounting research has established that there are serious limitations that blight the meaningfulness of accounting information. These limitations, as far as meaningfulness is concerned, have been elaborated upon extensively in the financial literature (see Evans, 2003; Francis and Schipper, 1999; Lev and Zarowin, 1999; Sterling, 1997). These studies found that the usefulness of accounting information in financial statements is decreasing. This suggests that there are limitations to the specification of conditions that are sufficient for accounting information to be meaningful.

In chapter 6 it was noted that the elements of financial statements do not have measurable attributes. It is evident from this that accounting information in financial statements cannot be verified. This means that the meaningfulness of

the information in financial statements changes with the opinion of the user. The purpose of this chapter, therefore, is to investigate whether necessary and sufficient conditions exist in the accounting discipline for accounting measurement information to be meaningful.

This chapter commences in section 10.2 with a brief discussion of the concept of representational meaningfulness. The relationship between the concept of meaningfulness and the nominal scale is discussed in section 10.2.1, followed by a discussion of the relationship between the ordinal scale and the concept of meaningfulness in section 10.2.2. In section 10.2.3 a discussion of the relationship between the interval scale and the concept of meaningfulness is provided, followed by a presentation of the relationship between the ratio scale and the concept of meaningfulness in section 10.2.4.

The chapter goes on to discuss the relationship between meaningfulness and permissible statistics in section 10.25. In section 10.3 a discussion of whether or not necessary and sufficient conditions exist for accounting information to be considered meaningful under the accounting conceptual framework is presented. The implications of statutory reporting requirements on the concept of meaningfulness are discussed in section 10.4, followed by an outline of the implications of the accounting concept of a scale on meaningfulness in section 10.5. A brief discussion of the implications of the going concern concept on meaningfulness is provided in section 10.6, followed by the implications of the objectivity of accounting phenomena for meaningfulness in 10.7 and the implications of the presentation of financial statements for meaningfulness in section 10.8. The chapter also discusses the relationship between meaningfulness and logic of hypothesis testing in section 10.9. The conclusion is reached in section 10.10.

10.2 The concept of representational meaningfulness

The concept of representational meaningfulness is one of the fundamental principles of representational measurement. Narens (2002) points out that the concept of meaningfulness arises from a position of enquiry typically taken by the enquirer. The meaningfulness of information depends on the questions being asked about it by the enquirer. It follows that information can be meaningful or meaningless, depending on what the enquirer wants from the information. It can also be inferred that information is meaningful if it is fit for the user's purpose.

According to Luce and Narens (1994), the concept of meaningfulness relates to the amount of truth that the given information contains about the object it is describing. Meaningful information is in other words that which accurately describes the properties that it purports to represent: information is meaningful if it is a true representation of the properties that it is describing. Measurement information must exhibit the properties of the empirical phenomena that it is representing. It can therefore be concluded that meaningful measurement information must be a mirror image of the phenomenon that it is representing.

Stevens (1951, 1946) ties the concept of meaningfulness to the concept of a scale (see chapter 4 for discussion on scales). He argues that the meaningfulness of information can only be known once the scale of measurement used in producing this measurement information is known. In chapter 4 it was noted that a scale is a rule that is used in a process of measurement. Rules of measurement reflect the conditions under which measurement information has been produced. Knowledge of the rules of measurement indicates whether particular measurement information is a true reflection of the properties of the measured object. It can also be inferred from this that the knowledge of a scale of measurement determines the type of analytical statements that may be made about measurement data that do not distort what the data stands for. Information that does not accurately describe the phenomena it wishes to cannot be regarded as providing an accurate portrayal of the phenomena it is describing. It also follows that an inaccurate

representation of a phenomenon may lead to inaccurate inferences about it being drawn from the information. Therefore, it can be concluded that information can only have meaning in a decision-making context if it is a true reflection of what it purports to represent and if it is relevant to the decision-making situation.

Luce *et al*. (1990) argues that the type of meaningful inferences that may be drawn from measurement information about an object can only be known once the scale of measurement is known. They argue that the scale of measurement specifies the type of statistical analyses which may draw meaningful information from measurement data. This viewpoint highlights the point that a scale of measurement specifies the permissible statistical analyses that may be done on measurement data. Therefore, measurement information may not be analyzed in the absence of the scale used to produce it. In chapter 2 it was noted that measurement information becomes unique once a scale of measurement is specified. This means that measurement information acquires peculiar properties that are associated with the scale of measurement used. Consequently, these peculiar properties of the rules of measurement (scale) determine whether a particular type of information is an accurate representation of the underlying object it is describing.

In the accounting discipline, the values of accounting phenomena are measured by monetary amounts (IASB, 2006). A scale of measurement in this discipline would specify the relationship between value and monetary units assigned to represent it. That is, it would specify how monetary units have been used to represent the properties of the values of accounting phenomena. In relation to the concept of meaningfulness described above, it would be expected that meaningful statements about accounting information are those that preserve the relationship between monetary units and value. Meaningfulness in measurement theory is defined as that information which is invariant under permissible transformations (Luce *et al*., 1990:267). This point of view suggests that one must know the transformations under which measurement information is invariant, before one

can consider this information meaningful. Meaning in the measurement context is a condition of measurement information that is achieved when all the statistical hypotheses that leave a measure invariant within the measurement system being used are formulated. That is, it is necessary to know all the scales of measurement that have been used in the process of measurement.

Stevens (1951) asserts that specific statistical tests may be performed on scales. If statistical tests that are not suitable for a specific type of a scale were to be conducted on this scale, they would distort the structure of the scale and it would no longer represent that relationship between the empirical relational structure and the numerical relational structure it is supposed to represent. One can see that the measurement information on which the unsuitable statistical tests were carried out would cease to be measurement information.

Similarly, Narens (2002:746) relates the concept of meaningfulness to the concept of invariance of scales when he states:

> …the only meaningful forms of measurement are equivalent to the representational theory; i.e., each meaningful set of measuring functions on a qualitative domain **A** has a characterization as a set of structure preserving mappings from a qualitative structure with domain **A** into a purely mathematical structure.

This indicates that it is only the representational theory of measurement that gives rise to meaningful measurement: only the representational theory of measurement incorporates the concept of meaningfulness into its measurements. It is clear that all representational measurements are meaningful owing to the presence of a scale of measurement in all representational measurements. The passage above also underlines the point that the concept of measurement meaningfulness exists in a measurement system if a meaningful set of structure preserving mappings exists that maps an empirical relational structure onto an abstract structure. This also underlines the importance of a scale of measurement in the construction of the concept of meaningfulness.

Structure-preserving mappings are described as homomorphisms (Bhattacharya *et al*., 1986:70). These are statistical tests that are equivalent to functions that preserve the relationship between an empirical relational structure and the numerical relational structure. According to Luce *et al*. (1971:9), the presence of these functions is equivalent to the presence of a scale. It can be established from this that the conditions meaningfulness under the representational theory of measurement are satisfied once the scale of measurement has been specified. The excerpt above also asserts that the only meaningful forms of measurement are equivalent to the representational theory. Therefore, it is only measurement systems that use the representational theory of measurement that give rise to meaningful measurement information.

The concept of meaningfulness is an absolute concept. According to Townsend and Ashby (1984:394), meaningfulness is an all or nothing concept. They argue that a statement cannot be almost meaningful. It is evident from this that the concept of meaningfulness is a dichotomous concept. That is to say, the concept is divided into two absolutely opposing parts. Either a scale is invariant under permissible transformations or it is not. It follows from this that all the permissible transformations on a scale of measurement must be known before its meaningfulness can be established. Stevens (1946, 1951), in his theory of scales of measurement, argues that the concept of meaningfulness may be viewed from the perspective of the usefulness of measurement information. He points out that information is meaningful if the use to which it may be put is known. This means that the concept of admissible transformation leads to the formation of meaningful or meaningless statements based on the type of transformations of the empirical relational structure made onto an abstract structure. Statistical procedures are classified according to the scale types for which they are permissible. Stevens (1951) also points out that the type of scale that eventuates from an assignment procedure can be one of four types of scale: nominal, ordinal, interval, or ratio. To illustrate the relationship between the concept of a scale, permissible statistics

and meaning, the concept of meaningfulness in relation to each scale is discussed separately below.

10.2.1 Meaningfulness and nominal scales

In chapter 4 it was established that the nominal scale represents the most unrestricted assignment of numerals. It was also noted (Stevens, 1951) that the numerals assigned are used only as labels. This suggests that the establishment of the concept of meaningfulness under a nominal scale is equivalent to finding the transformations that preserve the relationship between individuals and their identifiers. It was also explained in chapter 4 that use of the nominal scale in accounting is evidenced by the classification of accounting phenomena into five main classes of transactions relating to the income statement and balance sheet, namely, assets, liabilities, equity, income and expenses. Transactions classified under these headings are discrete and qualitative, they imply no order, nor can they be added. The concept of meaningfulness is applied to accounting transactions classified into these five classes When an analysis of the transactions in a class is carried out, for example, expenses, it is required that such an analysis should only express that the expenses are discreet, qualitative, they imply no order and that they cannot be added. This means that the statistical analyses that can be carried out are limited, for instance, to finding the item that occurs most frequently in a class, the number of cases in a class and other analyses that preserve identity and difference. Therefore, the statistical analyses that may be carried on nominal data should be limited to summary statistics such as the mode, the number of cases and contingency correlation that require only that the identity of the phenomena be preserved.

10.2.2 Meaningfulness and the ordinal scale

The concept of the ordinal scale was discussed in chapter 4. It was noted that the ordinal scale arises from the operation of rank ordering. The concept of rank ordering in an ordinal scale assists in the determination of greater or lesser with regard to the quantity of an attribute in an object. In chapter 4 it was also mentioned that an order relationship can hold in only one direction when it is viewed relative to two members of a set. This means that for a relationship to be an order relationship it must first be asymmetrical (that is, it must hold in only one direction).

In section 10.2 it was noted that the concept of meaningfulness in measurement is tied to the concept of scale. Meaningful statistical analyses are those that preserve the structure of the scale in measurement. With respect to the ordinal scale, meaningful statistical analyses are those that preserve the order relationship among objects.

In chapter 4 it was noted that the classification of current assets or current liabilities in increasing or decreasing order of liquidity in the balance sheet implies the use of the ordinal scale. This means that the order among current assets or current liabilities in the balance sheet is defined by their liquidity. If statistical analyses are carried out to obtain information on the order indicated by the liquidity relationship among current assets or current liabilities in the balance sheet; such analyses can only make sense if they provide information that is consistent with the order relationship that is defined by their liquidity. Information can only be described as meaningful in relation to the relationship of liquidity among current assets in the balance sheet if it describes that relationship.

Stevens (1951:25) also argues that if a scale preserves meaning under some class of transformations, then statistical analyses of measurement information should be restricted to statistics whose meaning would not change if any of those transformations were applied to the data. This indicates that the meaning of ordinal data does not change under transformations that preserve order.

According to Luce *et al.* (1971:11) transformations that preserve order are monotonic functions. Permissible transformations on an ordinal scale are thus monotonic transformations.

The nature of permissible transformations on ordinal scale data can be inferred from the structure of the ordinal scale. Using the description of ordinal scale measurement given by Luce *et al*. (1971:11), deductions of expressions of the representation and uniqueness theorems on ordinal scale measurements are made to show that the structure of these scales can only be preserved under monotonic transformations. This deduction is given below:

To show an expression of the representation theorem, assume that a scale, b, is used to assign real numbers in a set of real numbers N to the elements of a set, S, of observed phenomena and it is required that the numbers be assigned so that for all *k* and *m* in S, b (*k*) >b (*m*) if and only if *k* is preferred to *m*. Therefore, it follows from this that,

$$S \xrightarrow{b} N \quad \text{such that; } k > m \rightleftarrows b(k) > b(m), \text{ for all k, m that are elements of S.}$$

This expression shows the process of measurement in which an empirical relational structure S is represented by a numerical relational structure N. The relation k>m in S is preserved by the transformation (scale b) that mapped it onto N. The representation of the relation k>m in S is given by b (k) > b (m) in N. This shows ordinal scale measurement.

When drawing inferences from measurement information it is necessary to understand the type of inferences that may be drawn. The inferences drawn should preserve the structure of the empirical relational system represented by the ordinal mapping. Stevens (1951:25) used the term permissible statistics to describe the type of statistical analyses that preserve the ordinality of the mapping shown above. Therefore, the expression of the uniqueness theorem for an ordinal

scale measurement is proved if there is a transformation *f* that is permissible for an ordinal scale if and only if:

$b(k) > b(m) \longrightarrow f[b(k)] > f[b(m)]$

This analysis indicates that ordinal scale data is invariant under all transformations that preserve order. According to Stevens (1951), the ordinal scale has a structure of what is called an isotonic or order preserving group. He asserts that this group is very large and includes all monotonic increasing functions, i.e. functions that never decrease and therefore do not have maxima. This reasoning reveals that the positive values on an ordinal scale may be replaced by their square or their logarithm or to perform a linear transformation, adding a constant or multiplying by another constant. In relation to the concept of liquidity that defines the order of current assets or current liabilities in the balance sheet, it can be inferred that the positive values of the liquidity of current assets or current liabilities can be squared without changing their order in the balance sheet. Furthermore, a constant may be added to these values or they may be multiplied by a constant without changing the order of current assets or current liabilities in the balance sheet. In addition to the statistical operations that are permissible on a nominal scale, the statistical operations appropriate to the ordinal scale data (see, Stevens, 1951) are median, percentiles and order correlation.

10.2.3 Meaningfulness and the interval scale

In chapter 4 the fact was highlighted that the interval scale is one that preserves relative differences. It was also noted that the interval scale is quantitative in the ordinary sense of the word. That is, almost all the usual statistical measures are applicable on an interval scale, unless they are the kinds that imply knowledge of a ”true” zero point. The zero point on an interval scale is a matter of convention or convenience, as is shown by the fact that the scale remains invariant when a constant is added (Stevens, 1951:27). This also means that the zero point on an interval scale has no meaningful statistical properties that can be attributed to it.

The establishment of the concept of meaningfulness under an interval scale is equivalent to finding the transformations under which an interval scale is invariant; that is under transformations that preserve its structure. Luce *et al*. (1971:10) point out that interval scales involve a difference operator. Consequently, the set of permissible transformations for interval scales data that are meaningful should preserve relative differences.

In chapter 4 it was explained that the interval scale is used in the accounting discipline in the measurement of monetary units. Monetary units are placed at equal intervals, so that they can be counted to give the total amount of monetary units paid to acquire a commodity, or the total amount assigned to an element of the financial statements during recognition. For example, consider an item costing ten dollars that is paid for using one-dollar bills. In order to get ten dollars it is necessary to count out ten one-dollar bills. It is important that the one-dollar bills are of equal worth so that ten of them can be counted to the get ten dollars needed to purchase the item. But if some one-dollar bills are worth much more than others, then perhaps fewer one-dollar bills need be counted to get to ten dollars. Therefore, the interval of worthiness cannot be considered to be equal among the one-dollar bills counted to give ten dollars. For an interval scale to hold, it is necessary that successive items in a relationship be at equal intervals in terms of that relationship. Meaningful statistical analyses about the ten dollars paid for the item are those that indicate that the one-dollar bills counted to get to ten dollars were of equal worthiness. Meaningful measurement information is that which tells the truth about the object it is describing.

It has already been pointed out in section 10.2.1 that the concept of permissible transformations is concerned with statistical analyses that are carried out on measurement information after establishing the uniqueness theorem. Therefore, using the example in section 10.2.2 to develop an expression for the uniqueness theorem for the interval scale, the order (>) operator is replaced by the difference (-) operator. It can then be inferred that a transformation f is permissible for interval scale values if and only if there is a constant c such that: b (*k*) -b (*m*) =c {f [b (*k*)] – f [b (*m*)]}. It follows that linear transformations in which the same constant

is added to each value or the multiplication of each value by a constant are permissible for interval scales (Stevens, 1951:25). Consequently, the statistics that are permissible in addition to those on the ordinal scale are the mean, standard deviation, order correlation and product moment correlation.

10.2.4 Meaningfulness and ratio scales

In chapter 4 it was noted that ratio scales are at the top of Stevens' (1951, 1946) hierarchy of scales. The point was also made that the ratio scale encompasses all the properties of the nominal, ordinal, interval and ratio scales. This means that ratio scales contain operations for determining equality, rank order, equality of intervals and equality of ratios. The establishment of the concept of meaningfulness under a ratio scale is equivalent to finding the transformations under which a ratio scale is invariant. The ratio scale is invariant under transformations that preserve its structure. Luce *et al*. (1971:10) assert that ratio scales preserve relative ratios. This indicates that ratio scales have a defined zero point which may not be changed. Consequently, it is possible to multiply ratio scale data by a constant but logs may not be taken nor may a constant be added. Therefore, using the example in section 10.2.3 to develop an expression for the uniqueness theorem for the interval scale, it can be inferred from this that the permissible transformations on ratio scale values satisfy: b (*k*) / b (*m*) = cf [b (*k*)] / f [b (*m*)] for some constant c. The statistics that are permissible on a ratio scale in addition to those of the nominal, ordinal and the interval scale are the geometric mean, coefficient of variation and decibel transformations.

It was discussed in chapter 4 that ratio scales are used in the accounting discipline in the measurement of monetary units and that ratio scale measurements are measurements on the extensive scale. This means that ratio scales have the same properties as natural numbers. In chapter 4 it was mentioned that monetary units are measured using the ratio scale. This suggests that monetary units also have the same properties as the natural numbers. In the paragraph above all kinds of statistical analyses that can be carried out on ratio

scale measurements were listed. In section 10.2 it was noted that meaningful statistical analyses are those that preserve the truth about the characteristics of the object they are analyzing. This implies that all types of statistical analyses may be carried out on ratio scale measurements because they tell the truth about the object they are describing. It follows that all types of statistical analyses may be carried out on monetary units as they have extensive properties. That is, they have the same properties as natural numbers. Consequently, monetary units can be divided by each other and multiplied by each other while still preserving their ability to be measured on a ratio scale.

10.2.5 Meaningfulness and permissible statistics

It was noted above in section 10.2 that the study of meaningfulness in measurement theory examines the relationship between the objects represented and the symbols used to represent them. Luce *et al*. (1971) point out that the relationship between an empirical relational structure and the numerical relational structure is called a scale of measurement. This means that the study of meaningfulness is equivalent to the study of the properties of a scale of measurement. Stevens' (1946, 1951) original development of ideas of meaningfulness and invariance are closely tied to the question of appropriate and permissible statistics. He argues that measurement information is meaningful under a set of permissible statistics that leave the scale used during measurement invariant. This claim suggests that permissible statistics are those statistical analyses that accurately reflect the properties of the object the measurement information wishes to represent. It follows that measurement information is meaningful when the statistical interpretations made of it do not change the phenomena that the information purports to represent. It can also be inferred that it is necessary to know in advance the type of statistical analyses that leave the scale of measurement used in producing measurement information invariant. If this is the case, it can also be inferred that the statements that define the meaning of measurement information should be specified with the information.

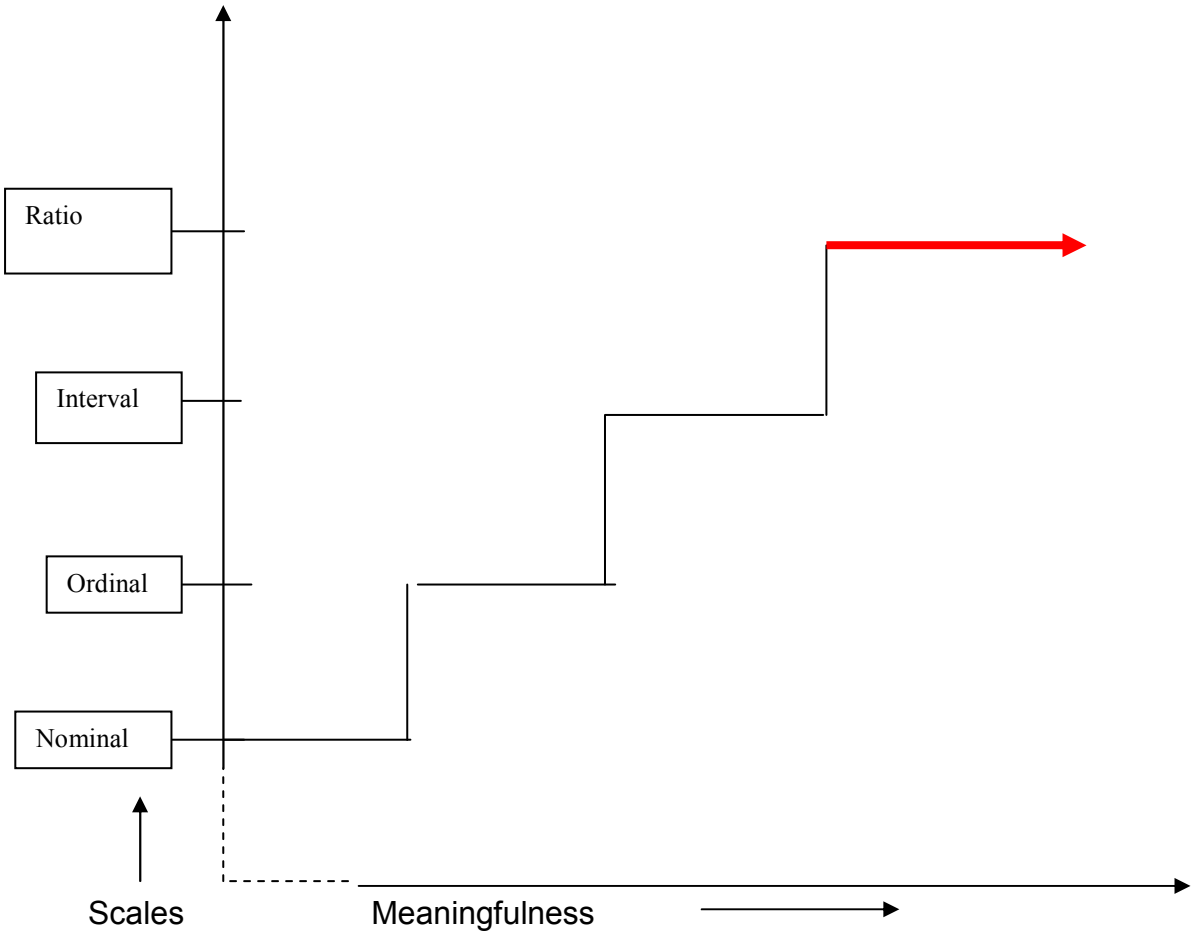
In the accounting discipline, authors such as Chambers (1997), Willet (1987), Staubus (2004) and Ryan *et al*. (2002) assert that the scale of measurement between value and monetary units is not specified. This means that the relationship between monetary units and value is not known. In section 10.2 it was highlighted that the specification of the scale of measurement is necessary for the establishment of the meaningfulness of measurement information. In other words, the meaningfulness of accounting information that describes the relationship between monetary units and value cannot be established. Therefore, the type of statistical analysis that may be applied to accounting information that describes the relationship between monetary units and value in order to draw accurate meaning about value cannot be specified. This creates a proliferation of statistical analyses that may be carried out on information about monetary units and value.

Luce *et al*. (1990:294) also suggest that the link between meaningfulness and statistics is obvious. They argue that statistical calculations involve various numerical functions f (x1…xk), such as the arithmetic mean or the standard deviation, for a set of measurements (e.g., x1.,…., xk), and as a result it seems reasonable to require that the numerical relations defined by such functions be meaningful relative to the underlying empirical structure. This demonstrates that statistical analysis of measurement information that is meaningful is equivalent to the mapping of measurement information onto an abstract structure, while preserving the structure of the phenomenon that is represented by the measurement information. It also follows that statistical analyses on measurement information should be meaningful relative to the underlying empirical structure. It can therefore be concluded that the term meaningfulness is used to capture the idea that information may have little, or a great deal of, meaning in the sense that it conveys knowledge about an object or state of affairs.

Stevens' (1951; 1946) typology of scales suggest that the determination of the meaningfulness of measurement information requires the specification of the scale used in measurement and the establishment of the statistical analyses that

leave the scale invariant. Under Stevens' typology of scale, scale types are evident from the data, independent of the questions asked of the data. In chapter 4 it was indicated that scale types can be nominal, ordinal, interval or ratio scales, and that these scales are arranged in a hierarchy. The lowest ranking scale is the nominal, followed by the ordinal and the interval with the top of the hierarchy being the ratio scale. The properties of lower ranking scales are incorporated in the higher-ranking scales. The meaningfulness of lower-ranking scales and permissible statistics on lower-ranking scales are incorporated into the higher-ranking scales. Therefore, it can be inferred from this that the meaningfulness of information increases in direct proportion to the increase in the permissible statistics, with the nominal scale being the least meaningful scale followed by the ordinal, interval and the ratio scale, which is the most meaningful. The following identity can be formulated: Let **M** be the meaningfulness of information, and let **S** be the permissible statistics, then **M** = k**S,** where k is a constant. Figure 10.1 below illustrates this relationship.

Figure10.1 Stevens' scales of measurement against the concept of meaningfulness



Source: Own Observation

Figure 10.1 illustrates the relationship between the permissible statistics and the meaningfulness of information. The distinguishing feature of this graph is that it reflects a step function. The most peculiar feature of the concept of meaningfulness is that, within the limits of a specified scale, meaningfulness does not change unless a new scale is introduced. It also reflects that either permissible statistics are defined within a specific scale or they are not. The graph also shows the hierarchy of scales. It indicates that lower ranking are incorporated in higher-ranking scales. The meaningfulness of lower-ranking scales is

incorporated in high-ranking scales. It is also clear from the graph that defining a high-ranking scale automatically implies the definition of lower-ranking scales. Furthermore, since it has been outlined in section 10.2 that meaningfulness is an all or nothing concept, the graph has an arbitrary starting point on both axes because it is not clear exactly what transpires before the nominal scale initially establishes meaningfulness.

10.3- Meaningfulness and the accounting conceptual framework

It was noted in chapter 3 that the perception (IASB, 2006; Wolk *et al*., 2001) in the accounting discipline is that financial statements cannot be prepared in the absence of measurement. The IASB framework (2006) for financial reporting points out that an item that the meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured with reliability. This indicates that the object of measurement in accounting is cost or value. In section 10.2 it was pointed out that a statement made about a measurement is meaningful if it leaves the object that has been measured invariant. This means that statements made about a measurement should be a true reflection of the properties of the object that has been measured. Statements made about accounting measurement information are meaningful if such statements are a true reflection of the properties of cost or value.

In chapter 3 it was pointed out (IASB, 2006) that the accounting conceptual framework establishes the basis for determining which events should be reported, how they should be measured and the format in which they should be communicated to users. This indicates that the accounting concept of measurement is subject to regulation by the accounting conceptual framework, which establishes the meaning of what is happening and regulates the activities of the compilers of financial statements. Consequently, if the accounting conceptual framework determines the way in which economic events should be communicated to users, this means that the accounting conceptual framework determines the type of information about economic events that may be

communicated. It is therefore clear that it is the accounting framework that determines the meaningfulness of accounting information.

Simonds (1982) points out that users of accounting information cannot make specific requests for this information from those preparing it because they do not know the type of information they need. Thus, it may be argued that the users have no control over the production of accounting information, and thus in a way the accounting conceptual framework dictates the uses to which accounting information may be put. Furthermore, unless the compilers make specific prescriptions about the use to which the information may be put, users may make any type of deductions from financial statements. It may therefore be argued that such prescriptions would highlight the type of deductions that could be made from the information.

Luce *et al.* (1971:12) assert that under the representational theory of measurement, every pair of uniqueness and representation theorems involves a choice of a numerical relational structure. They argue that this choice is essentially a matter of convention and these conventions are strongly affected by considerations of computational convenience. This suggests that the choice of a numerical structure when proving the representation and uniqueness theorems of representational measurement is relative to a specific frame of reference. Since, as was pointed out in section 10.2, measurement information is meaningful once the uniqueness theorem of a process of measurement has been proved, the meaningfulness of measurement information is relative to a specific frame of reference.

According to Stevens (1951:1), measurement is more immediately the goal in the experimental corner, where the patient sifting of facts and relations has disentangled some of the relevant variables. The phrase “the patient sifting of facts” indicates that in a process of measurement there are some facts that are relevant to that process of measurement and some that are not. The choice of which facts are relevant and which are not is the task of the immediate

environment in which the measurement takes place. This perspective also indicates that the choice of a process of measurement is the concern of the immediate environment and it is this environment that knows exactly what it wants to measure and what it wants to achieve with the measurement. It follows that the individuals performing the process of measurement also know with certainty what information the process of measurement intends to elicit.

The above analysis indicates that the process of measurement is specific to an environment. Since, as has been noted in section 10.2, this process determines the meaningfulness of measurement information, it can be inferred that the meaningfulness of measurement is specific to a measurement environment. As the conceptual framework of accounting (IASB, 2006) establishes the basis according to which accounting phenomena should be measured, it can be inferred that this framework determines the meaningfulness of accounting information. Thus the meaning of accounting measurement information has to be evaluated in accordance with the frames that establish the meaning of what is going on and regulate the activities of accountants.

10.4 Meaningfulness and statutory requirements

In chapter 3 the point was made that the accounting conceptual framework for financial reporting (IASB, 2006) establishes the basis on which financial statements should be prepared. The reason the principles of generally accepted accounting practice are used in South Africa as a basis for preparing financial statements is due to statute. Benade *et al*. (2006:205) point out that, in order to achieve fair presentation of the state of affairs and the profit (or loss) of the company in the South African reporting system, financial statements should comply with the requirements of the companies Act and Schedule 4 and conform to generally accepted accounting practice. They also argue that the format and content of company financial statements are prescribed by the Companies Act of 1973, more specifically by the Fourth Schedule thereof, and Statements of Generally Accepted Accounting Practice that are published by the South African

Institute of Chartered Accountants. This indicates that all companies in South Africa are required by law to prepare financial statements according to the principles of generally accepted accounting practice published by the South African Institute of Chartered Accountants, regardless of what the wishes of a company might be. Moreover, even if an accountant has an alternative accounting treatment of accounting phenomena, in most cases he or she has to abandon this in favour of the treatment that is prescribed by the principles of the Companies Act of 1973.

In chapter 8 the effect of the accountant's environment on his or her cognition was discussed. It was also pointed out that an accountant's judgments are affected by the culture to which he or she is exposed. Therefore, if as outlined above (Benade, *et al*., 2006:205), the Companies Act of 1973 requires that the financial statements of companies should be prepared in accordance with the principles of generally accepted accounting practice, it can be inferred that the accountant has to be familiar with these principles in order to prepare the financial statements of a company. In this case, the principles of generally accepted accounting practice could be considered to be part of the culture of the accountant. This would mean that the accountant's intuition with regard to accounting is influenced by the principles of generally accepted accounting practice.

According to Mattessich (1964:79), accounting measurements are measurements by fiat. He argues that accounting measurements are dependent on the intuition of the accountant.. If, as outlined above, the accountant's intuition is affected by the statutory requirements, it can then be inferred that accounting measurements are also affected by statutory reporting requirements.

Luce *et al.* (1971:12) point out that every pair of the representation and uniqueness theorems involve a choice of a numerical relational structure. They argue that the choice of this structure is essentially a matter of convention, although the conventions are strongly affected by considerations of computational convenience. Since the Companies Act of 1973 requires that financial statements

are prepared in accordance with the principles of generally accepted accounting practice, then the considerations of computational convenience in choosing the numerical relational structure must be defined by the principles of generally accepted accounting practice. The IASB (2006, Para 99) defines measurement as "the process of determining the monetary units at which the elements of the financial statements are to be recognized and carried in the balance sheet and income statement". This suggests that all accountants should choose monetary units as the abstract structure onto which the attributes of economic phenomena can be mapped. Consequently, accountants cannot use abstract structures of their choice apart from monetary units to represent the attributes of economic phenomena.

As has been pointed out in section 10.2 above, proving the representation and uniqueness theorems is essential to establishing the meaningfulness of measurement data. It was also made clear in chapter 2 that numerical statements involving measurement representations are meaningless unless a particular representation is specified. In this case, the representation specified by the IASB (2006, Para 99) framework for financial reporting that should be used for preparing financial statements is the monetary unit (e.g., Rand, Dollar, etc.). It was also noted in section 10.2 that meaningful statements about measurement data are those that leave the representation used invariant. Therefore, the only meaningful statements that can be made about the information in financial statements are those that leave the monetary unit invariant. It is clear from the discussion in this section that the meaningfulness of accounting measurement data is determined by statutory requirements. Meaningful statements about accounting measurement data are those that leave the scale used in monetary units representations invariant.

10.5 Meaningfulness and the accounting concept of a scale

In section 10.2 it was noted that measurement information is meaningful once a scale of measurement is specified. The association between the concept of

meaningfulness and the scale of measurement in the traditional form of representational measurement theory is explained by Narens (2002:760) as follows:

> A qualitative structure **X** is selected to capture the domain **A** of interest; a mathematical representing structure **N** is selected to measure **X** in terms of the scale **S** of homomorphisms of **X** into **N**; and meaningfulness is identified with a form of invariance associate **S,** e.g. with **S-** invariance.

This extract indicates that for measurement to take place, it is necessary to specify the qualitative structure of the phenomenon that one intends to measure and the mathematical structure one intends to use to represent the identified phenomenon. From the explanation above it is clear that a scale of measurement explains how an individual has used a mathematical structure to represent an empirical relational structure. It is also evident from this that in the absence of a specified scale of measurement, it would be impossible to know how a mathematical structure has been used to represent an empirical relational structure. It follows that, if a scale of measurement is not specified, it would not be possible to relate the numerical relational structure to the empirical relational structure that it is meant to represent. It is therefore clear from this that if this relationship (scale) cannot be established it will not be possible to draw useful inferences from the representing structure. The explanation above also highlights the need for the scale to be invariant. It is essential that the relationship between an empirical relational structure and a numerical relational structure stay the same. If this relationship was always changing it would be not possible to establish the real and exact relationship between the empirical relational structure and the numerical relational structure. The scale would become ambiguous and, as a result, inferences drawn from the scale would not be meaningful. It follows then that it is also necessary to specify the scales of measurement used in the measurement of accounting phenomena if accounting information is to be considered meaningful.

It was noted in chapter 4 that Stevens' (1951, 1946) typology of scales (nominal, ordinal, interval, ratio) is not properly applied in the measurement of the attributes of accounting phenomena. In accounting measurement, the nominal scale has been accorded characteristics that are beyond identity and difference. In particular, it has been used to effect the operation of addition on expenses in the income statement. This operation can only be carried out on measurements that can be shown to be structurally identical (Luce, 1996). The monetary amounts that are used to represent the attributes of expenses in the income statement have not been shown to be structurally identical. In fact, authors such as Ryan *et al*. (2002) and Willet (1987) point out that it is not exactly clear what the monetary units in financial statements represent. This indicates that it is not possible to establish whether the empirical relational structures that are represented by the various monetary amounts in financial statements are structurally identical. Structural identity is essential in the aggregation of measurements.

In section 10.2 it was outlined that measurement data are meaningful under transformations that leave the scale of measurement invariant. This means that statistical analyses should be limited to those that are permitted for that kind of a scale. In section 10.2.4 it was explained that the permissible transformations on a nominal scale are limited to summary statistics such as the mode, the number of cases and contingency correlation that require only that the identity of the phenomena be preserved. Therefore, the operation of addition on a nominal scale cannot be considered to yield meaningful results since this transformation is not permissible on a nominal scale.

The concept of an ordinal scale in accounting was also discussed in chapter 4. It was noted that the requirements that are necessary for an ordinal scale to exist are not satisfied. For instance, it was established that the characteristics of the property of liquidity that orders current assets according to increasing or decreasing liquidity are not specified. In order for measurement to occur, the characteristics of the property that is being measured must be specified (Narens,

2002). If the characteristics of the property that is being measured are not specified it is not possible to prove the representation theorem of representational measurement. It is thus clear that there is no ordinal scale measurement of the property of liquidity. As outlined in section 10.2, measurement representations are meaningful if the empirical relational structure has properties that are measurable on well-founded scales, thus it can be inferred that the property of liquidity is not currently meaningfully measured in accounting. Permissible statistics can only be specified on measurement data if it can be shown that the underlying phenomenon that the measurement data represents is measurable on a scale that can be specified. In the case of liquidity, it must be shown that liquidity has properties that are measurable on an ordinal scale.

In chapter 4 the concept of ratio scale measurement in accounting was discussed. It was shown that the value of an element of the financial statement is not measurable on a ratio scale as suggested by the accounting literature. For instance, Abdel-Magid (1979:355) points out that the property subject to measurement in an exchange transaction is exchange value, which is measured by the monetary numerosity at the time of exchange. He argues that at the time of exchange, the equality of ratios can be verified by an empirical operation. This suggests that ratio scale measurements of monetary units represent the properties of value. But there is no empirical evidence to support the view that value has properties that are measurable on a ratio scale. Authors such as Stamp (1981), Ryan *et al*. (2002) and Willet (1987) have noted that value is an ambiguous concept that does not have a precise definition. All measurable phenomena must have a precise definition, however, and must be invariant (Luce *et al*., 1971:13). This indicates that the argument that the value of an element of financial statements is measurable on a ratio scale is unfounded.

In section 10.2 it was pointed out that measurement representations are meaningless unless a scale of measurement is specified. In the case of monetary units, measurement is on the ratio scale. In section 10.2.3 it was noted that the statistics that are permissible on a ratio scale, in addition to those of the nominal,

ordinal and the interval scale, are the geometric mean, coefficient of variation and decibel transformations. The choice of permissible statistical tests for a given set of data depends on the representation and uniqueness theorems (section 10.2). This indicates that permissible statistical tests on monetary units should leave the properties of value invariant. However, since it was mentioned in chapter 6 that value is an ambiguous concept that does not have a precise definition, it is clear that it is impossible to know for sure whether the permissible statistical tests on monetary units can leave the properties of value represented by monetary units invariant.

10.6 Meaningfulness and the going concern concept

In chapter 5 the implications of the going concern concept on representational measurement were discussed. The financial statements of business entities whose operations are expected to continue for the foreseeable future are prepared under the going concern assumption. According to Sterling (1968), all statements prepared under this assumption are provisional and dependent on subsequent events for the preparation of final and accurate statements. This suggests that statements prepared under going concern do not represent economic reality. Statements that represent economic reality can only be prepared once subsequent events have occurred. Sterling (1968) also points out that under going concern, subsequent events always lie in the future and can never be known. This suggests that economic reality cannot be known under going concern. According to Sterling (1979:223), measurements are made at a specific point in time. He argues that the purpose of measurement is to discover the magnitude at a particular point in time without regard to what has gone before or what will come after. This viewpoint suggests that future or subsequent events play no part in the process of measurement. Since the financial statements that are prepared under the going concern assumption contain information that is dependent on subsequent events, the implication is that accounting phenomena are not measurable under the going concern assumption.

As noted in section 10.2, the meaningfulness of a set of measurement data depends on successfully proving the representation and uniqueness theorems on the set of measurement data. This means that the measurement data should be representative of the underlying empirical relational structure and that the numerical statements that may be made on the measurement data leave the empirical relational structure represented by the data invariant. As pointed out above (Sterling, 1968), the truth of the information in financial statements is dependent on subsequent events. It can thus be inferred that the proof of the representation and uniqueness theorems of the information in the financial statements is also dependent on subsequent on events. If this is the case, the specification of the permissible statistics on the information contained in the financial statements is also dependent on subsequent events. The meaningfulness of measurement information depends on permissible statistics on that information (section 10.2): it can therefore be concluded that the meaningfulness of accounting information prepared under the going concern assumption cannot be determined.

10.7 Meaningfulness and the objectivity of accounting phenomena

Stevens (1946), associates meaningfulness with invariance under permissible statistics (see section 10.2). This means that the statistical analyses that are carried out on a set of measurement data should also be representative of the underlying empirical relational structure that the data set represents. This also indicates that the underlying empirical relational structure should be objective. That is, the empirical relational structure should be capable of being empirically verified.

Similarly Narens (2002: 761) states:

> X is said to be a structure with meaningful primitives if and only if x is a qualitative structure and each primitive of X is meaningful.

This points out that a phenomenon that is subject to measurement can give rise to meaningful measurements if the phenomenon itself is meaningful. According to Luce and Narens (1994), a qualitative structure and its primitives are meaningful if the qualitative structure has primitives that can be represented by a numerical relational structure: the qualitative structure can only be meaningful if it has attributes that are measurable. It can be inferred from this that the object of measurement can only lead to meaningful measurements if it has properties that are compatible with the principles of the representational theory of measurement. In chapter 2 (Luce *et al*., 1971) the point was made that a phenomenon is measurable if it has a qualitative structure that can be specified, and attributes that can be specified and which have empirical identities. In other words, phenomena that lead to meaningful measurements are those that have attributes that are empirically testable.

The IASB (2006, Para 83) framework for financial reporting asserts that an item that meets the definition of an element of financial statements should be recognized in the financial statements if the item has a cost or value that can be measured with reliability (see. chapter 6). This point of view indicates that the phenomena that are subject to measurement in accounting are cost or value. It follows that cost or value should be objects that can be objectively determined. It can also be inferred that the statistical analyses carried out on the abstract structures that represent cost or value should leave the cost or the value of an element of the financial statement invariant.

However, cost and value are both subjective concepts. Authors such as Stamp (1981), Willet (1987), Chambers (1997) and Staubus (2004) point out that value is an ambiguous concept and not an intrinsic property of an accounting entity. This suggests that value is not objective and cannot be determined objectively. The concept of cost cannot be determined objectively either because there is no agreement in accounting on what constitutes cost. This is made clear in a definition of cost. The IAS 38 (2006, Para 8) defines cost as follows:

> Cost is the amount of cash or cash equivalents paid or the fair value of other consideration given to acquire an asset at the time of its acquisition or construction…

This suggests that cost is used as the value of the measurement function. Yet, cost was earlier (IASB, 2006, Para 83) referred to as the domain of the measurement function. It was classified as the attribute that is the subject of measurement in accounting. This indicates that the accounting discipline has not fully recognized the distinction between the preformed theoretical constructs of the empirical relational system, the measurement function and the value of the measurement function. The absence of specified empirical relational structures for both cost and value imply that they are not measurable. Since it has been noted above (Luce and Narens, 1994) that meaningful measurements can only be constructed from phenomena that are measurable, it can be concluded that the empirical relational structure of both cost and value do not lead to meaningful measurements.

10.8 Meaningfulness and the presentation of information in the financial statements

In chapter 9 the implications of information that is presented in financial statements on representational measurement were discussed. It was noted that accounting information is presented in financial statements in a way that is not consistent with the principles of representational measurement. For example, the monetary amounts representing the values of different current assets are aggregated in the balance sheet when there is no evidence suggesting that they should be added to each other. In the income statement, different items of income are added to each other, and different items of expenses are added to each other to arrive at the total income and total expenses respectively. According to Luce (1996:89), measurements can only be added if they are shown to be structurally identical. This means that the measurements should be based on an identical

scale of measurement if they are to be considered structurally identical. Therefore, before the monetary amounts representing the values of current assets can be added to each other, it should be shown that they are on an identical scale of measurement.

There is no evidence in the accounting literature, however, to suggest that monetary amounts that represent the values of elements of financial statements can be added together in financial statements. Ryan *et al*. (2002) point out that there is currently no agreement that relates monetary units to the value of an accounting phenomenon. In other words, it is not known how the units of value relate to the monetary units. Willet (1987) also points out that in the accounting discipline it is not known exactly what monetary units represent and thus what different monetary amounts in the financial statements represent. If this is the case, it can be inferred that there is no specified scale that explains how monetary units are assigned to the units of the value of an element of the financial statement.

In section 10.2 it was noted that measurements are meaningful once a scale of measurement is specified. Furthermore, it was pointed out that the only meaningful forms of measurement are equivalent to the representational theory. It is clear from this that information in financial statements can only be meaningful if the scales of measurement that have been used to assign monetary units to the values of accounting phenomena are specified and if the accounting information presented in financial statements is compatible with the principles of the representational theory of measurement. Therefore, the absence of a specified scale in the accounting discipline and the incompatibility of the accounting information presented in financial statements with the principles of representational measurement that have been specified above indicates that the accounting information in financial statements is not in harmony with the representational measurement concept of meaningfulness.

10.9 Meaningfulness and the logic of hypothesis testing

In section 10.2 the point was made (Stevens, 1951,1946) that the meaningfulness of statements about measurement information for different scale types is preserved under permissible transformations on those scales. This means that when specifying the meaningfulness of measurement information, the scale of measurement used in a process of measurement as well as the permissible statistics for that particular type of scale must also be specified. Once the scale of measurement and permissible statistics on a set of measurement data have been specified it is possible to determine whether a set of measurement data is meaningful.

However, Stevens' (1951, 1946) link between meaningfulness and permissible statistics is controversial. This link fails to take into account the logic of statistical hypothesis testing. Lord (1946) reflected the weakness in Stevens' (1946) work on meaningfulness by showing that the choice of permissible statistical tests for a given set of data does not depend on the representation and uniqueness theorems, but rather that they are dependent on the question they are designed to answer. It can also be inferred that this logic of meaningfulness of measurement data depends on data distributional assumptions: that is, if the data distributional assumptions are true, then the statistical calculations follow and provide firm grounds for inferences. If this logic is applied to accounting measurement it means that the nature of the statistical tests conducted on accounting information should not depend on how monetary amounts represent the values of the elements of financial statements (proving the representation and uniqueness theorem), but rather on whatever the user wants to use the information for.

Guttman (1977) points out that the statistical interpretation of data depends on the questions asked of it and on the kind of evidence that the enquirer would accept to inform him about that question. This means that it is the enquirer who determines what he wants from the information. This suggests that the questions asked of accounting information should be determined by the users of the

information and not by the accountants or any other persons involved in the production of accounting information. The users know how they will use this information. They carry out statistical tests on accounting information that reveal whether this information is suitable for the task they want to perform.

10.10 Summary and Conclusions

The concept of meaningfulness is fundamental to every process of measurement. The inability of a process of measurement to establish the meaningfulness of the measurements it produces is a clear demonstration that it is not a process of measurement. Accounting is currently considered to be a measurement discipline. One would therefore expect accounting information to be meaningful. Meaningful statements about measurement information are those that preserve the relationship between the numerical relational structure and the empirical relational structure. Meaningful statements leave the scale of measurement invariant. In this chapter it has been noted that accounting information is not meaningful.

Despite the fact that the accounting literature suggests that accounting is a measurement discipline, an analysis of accounting measurement information indicates that this information is not meaningful. A recap of some of the main points discussed in this chapter is provided below:

- The meaningfulness of statements about measurement data is preserved under transformations that are permissible on that data. Permissible transformations are those transformations that leave the scale of measurement used in a process of measurement invariant. A scale of measurement specifies the statistical procedures that may be carried out on measurement information. The concept of meaningfulness is an all or nothing concept. Either a statement is meaningful or it is not.

- The object of measurement in the accounting discipline is value or cost. Monetary units are used to represent the value of the elements of financial statements. This means that in the accounting discipline, meaningful

statements about measurement information are those that preserve the relationship between monetary units and value.

- In the accounting discipline there are no specified scales of measurement. Yet measurement information is meaningful once a scale of measurement is specified. Therefore, it is clear that accounting measurement information is currently not meaningful.

- The value of an element of the financial statement is ambiguous. Thus, it follows that the value of such an element cannot be empirically tested. This means that the invariance of value cannot be established when a statistical procedure is performed on measurements of value. It follows from this that the meaningfulness of accounting information cannot be established.

- The statements prepared under going concern are dependent on subsequent events. These statements cannot be empirically verified. It has been noted in this chapter that meaningful statements are those whose invariance can be established. Therefore, it is clear from this that the meaningfulness of statements prepared under going concern cannot be established.

- In this chapter attention has been drawn to the fact that accounting information is presented in a way that is not consistent with the principles of representational meaningfulness. Monetary amounts representing different elements of financial statements are added or subtracted to or from each other. Such additions can only take place if it can be proved that the monetary amounts represent identical attributes of the elements of the financial statement, under the same scale of measurement. In the accounting discipline it is not known whether different monetary amounts in financial statements represent identical attributes. As a result, such additions are not permissible.

The obvious conclusion that can be drawn from this chapter is that the numerical assignments made in the accounting discipline cannot be considered to be meaningful. They do not meet the requirements of the principles of the representational theory of measurement that establish meaningfulness.