Chapter 3 -Representational measurement and the goals of accounting

3.1 Introduction

Measurement is a term of common usage in contemporary accounting literature. Its frequent use in accounting has made it virtually synonymous with accounting practice. The definition of accounting also implies that measurement is part of the traditional accounting methodology. For example, Wolk *et al.* (2001), Kirk (2005) and the IASB (2006) all define accounting as the art of measuring and communicating accounting information. This definition gives the impression that the accounting concept of measurement is based on firm foundations of measurement that would be expected of any measurement discipline in its category.

The theory of measurement that establishes measurement in the social sciences is the representational theory of measurement. As accounting is currently classified as a social science one would expect accounting measurement practices to be compatible with the general principles of measurement that are applicable to measurements in their class.

However, as has been outlined in chapter 1 (e.g. Chambers, 1997; Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Paton and Littleton, 1940; Staubus, 1985; Staubus, 2004; Sterling, 1966), there is consensus that the accounting discipline has not succeeded in creating a theory of accounting measurement from the observation of accounting practices of measurement. Yet, every process of measurement must have a theory of measurement (Narens, 2002). If this is true, it suggests that the lack of a created theory of accounting measurement casts doubt on the belief that current accounting practices are practices of measurement. This creates confusion with regard to whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement.

The reason accounting practices do not give rise to a theory of measurement is not known in accounting (see Chambers, 1997; Staubus, 1885; Staubus, 2004). As one of the starting points in this ongoing investigation, this chapter evaluates the compatibility of the objectives of accounting with the principles of representational measurement. This is because the process of measurement is carried out only if there is an established purpose to be achieved by this process (Narens, 2002). It is clearly evident from this that the purpose of measurement should be identified first, before measurement takes place. It also follows that the purpose of measurement must be compatible with the process of measurement for measurement to take place. Therefore, it can be argued that if accounting is a measurement discipline as implied in the literature, then the objectives of accounting should be in harmony with the principles of representational measurement.

The purpose of this chapter is to investigate whether the definition and the objectives of accounting are in harmony with the principles of the representational theory of measurement. In chapter 2 it was noted that every process of measurement presupposes the achievement of a goal. It is therefore necessary to determine whether the definition and objectives of accounting are in harmony with the principles of representational measurement.

This chapter commences with a discussion of the role of measurement in the preparation of financial statements in section 3.2, followed by a discussion of the accounting implications of the principles of representational measurement in section 3.3. The chapter continues with a discussion of the measurement implications of the objectives of accounting in section 3.4. The chapter closes with a conclusion in section 3.5.

3.2 The role of measurement in the preparation of financial statements

The concept of measurement plays a pivotal role in the recognition of economic phenomena in financial statements. Recognition is the process of incorporating an item that meets the definition of an element of the financial statements, and also meets the recognition criteria, in the financial statements. According to the IASB framework (2006) for financial reporting, an item that meets the definition of an element of financial statements should be recognized in the statements if it has a cost or value that can be measured with reliability. This statement suggests that there is no accounting transaction that can be recognized in the financial statements unless it has a cost or value that can be measured with reliability. It also implies that no financial statements can be prepared in the absence of a process of measuring value. It is to be expected that accounting should have a theory of measurement that clearly states the foundations of measuring the cost or the value of an item that meets the definition of an element of the financial statement.

The IASB framework (2006) for financial reporting defines measurement as the process of determining the monetary amounts at which the elements of financial statements are to be recognized and carried in the income statement and balance sheet. Evidently, the monetary amounts are used to represent the cost or the value of an element that is recognized in the financial statement. It would also be expected that the accounting discipline has a theory that describes the determination of the monetary amounts at which the elements of the financial statements are carried in the income statement and the balance sheet. It is clear from this that no financial statements can be prepared in the absence of measurement. It follows that measurement forms the major part of the methodology for preparing financial statements. It can be concluded from this that no financial statements can be prepared in the absence of measurement.

3.3. Accounting implications of measurement

In this section the measurement implications of the purpose of accounting are discussed. The purpose of accounting in this section is inferred partly from its definition and partly from other statements extracted from the accounting literature. In the accounting literature the term measurement is commonly used to mean the assignment of monetary units to accounting phenomena. The purpose of accounting is to represent the empirical relational structures of accounting phenomena by monetary units. An analysis of the definition of accounting also suggests that the accounting concept of measurement hinges on the assignment of monetary units to accounting phenomena. For instance, Bierman (1963: 501) defines accounting as follows:

> Accounting is the art of measuring and communicating financial information.

This definition indicates that accounting is a measurement discipline that specializes in measuring financial phenomena: it therefore specializes in measuring phenomena that can be expressed in monetary terms. Thus, it can be concluded that the purpose of accounting is to create financial information through the act of measurement.

Similarly, Wolk *et al.* (2001:172) (see also AICPA, 1953, Para 5) state:

> 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 results thereof.

The use of the word “classifying” suggests that accounting is a measurement discipline. According to Stevens (1946), classification is the most basic form of measurement. If the nature of accounting is such that it is a measurement discipline then the accounting concept of measurement comes to mean no more than traditional accounting methodology. Accounting is also described as an

explanatory discipline that utilizes measurement as its primary mode of description (Larson, 1969). Therefore, the summarization of transactions and events in terms of money is considered in the accounting discipline to be an act of measuring accounting phenomena. This view is supported by Abdel-Magid (1979:355) when he states:

> The property subject to measurement in an exchange transaction is exchange value, which is measured by the monetary numerosity at the time of exchange. At the time of exchange, the equality of ratios can be verified by an empirical operation.

The general belief in the accounting concept of measurement is based on the representation of the empirical relational structure of value by an abstract structure of monetary units. Furthermore, the accounting standards indicate that monetary units are a measure of value in accounting. For example, IASB (2006, Para 83) states:

> An item that meets the definition of an element should be recognized if:
>
> a) It is probable that any future economic benefits associated with the item will flow to or from the entity; and
> b) The item has a cost or value that can be measured with reliability. “

It is clear from this extract that even expectations are measurable in the accounting discipline. This is consistent with the principles of the representational theory of measurement. Expectations have legitimate properties in the present that are measurable (Orbach, 1978). The extract also points out that value and cost are attributes that are measurable in accounting: the domain of the measurement functions in accounting is cost or value.

However, in spite of the suggestions that the objective of accounting is to measure accounting phenomena, it should be pointed out that a thorough analysis of the accounting concept of measurement falls short of the requirements of the representational theory of measurement. For example, the summarization of

transactions and events in terms of money referred to above (AICPA, 1953) cannot be an act of measurement. It is alleged that there is no property which is measured by the financial statements apart from the numerosity of monetary units (Willett, 1987). This suggests that the concept of value is not adequately defined in the accounting discipline. What is more, value is an ambiguous concept that is not an intrinsic property of an accounting entity (Stamp, 1981). Stamp also points out that as a result of the ambiguous nature of value there is no general agreement among accountants on the meaning or relevance of "value". Yet, according to Decoene *et al.* (1995), under the representational theory measurement magnitudes are historically and theoretically determined reflections of quantitative aspects of objectively existing entities and not merely the outcome of metricization or measuring procedures. In this case value is not objective and therefore it cannot be measured.

Goldberg (2001) asserts that the primary objective of accountants is ascertaining and presenting the truth. Since accounting is considered to be a measurement discipline this statement may be interpreted to mean that accounting measurements reflect the truth. These points of view imply an exactness associated with accounting that is wholly inconsistent with the approximating character of measurement. Measurement is never any more than an approximation (Larson, 1969). This means that measurements are never a true reflection of the object of measurement. Margenau (1959:136) is also very clear on the approximation nature of measurement when he states:

> An empirically "true" value of a measured quantity does not exist. What passes for the truth among the results of measurement is maximum likelihood; a concept that attains meaning if a statistical sample of differing measured values is available.

This would suggest that there are no exact measurements. Every measurement discipline must therefore introduce the concept of error in its measurements. It

follows that, if accounting is a true measurement discipline it should be able to deal with the concept of error.

Moreover, the American Accounting Association (1971) suggests that accounting is indispensable in measuring and reporting organizational wealth and its changes. The necessity of determining preformed theoretical constructs of the properties or qualities to be measured in accounting is implied by the major premise that accounting is a measurement discipline and the minor premise that all measurement presupposes something to be measured (Larson, 1969). However, the problem is that the attributes of wealth that are the subject of measurement are not specified. That is, there is no specification of the property of a class of accounting objects which it is of use and interest to measure in the quantification of wealth. But, 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). If the attributes that are supposed to be measured are not specified, it is not possible for measurement to take place. It is not possible for researchers to measure something that is unknown to them. In addition, there is no specification of the appropriate measurement procedures to be employed in assigning numbers to represent those properties.

This analysis has not exhausted all the points on which issue may be taken with the belief that accounting is a measurement discipline. However, sufficient points have been identified to put in serious doubt the belief that measurement is part of the traditional accounting methodology. Therefore, it can be concluded from this analysis that the accounting concept of measurement is not in harmony with the principles of measurement.

3.4 Representational measurement and the objectives of the financial statements

The concept of measurement presupposes the achievement of a goal. Unless the goal of measurement is known, measurement is not possible. Caws (1959:3) is

very clear on this: “Measurement presupposes something to be measured, and, unless we know what that something is, no measurement can have any significance.”

This means that measurement presupposes the comprehension of the principal state. Therefore, it follows that one cannot represent by numbers phenomena which one does not know. Since accounting is concerned with user needs, a set of objectives relating to user needs stands at the apex of the metatheory (Wolk *et al.* 2001). Accounting measurement should be congruent with the objectives of financial statements. If this is the case, it can be inferred that a comprehension of the objectives of the financial statements implies a comprehension of the principal state of accounting phenomena.

In an attempt to establish the objectives of financial statements, the accounting discipline set up the Trueblood committee (AAA, 1971) to investigate and compile a report on the objectives of financial statements. These objectives have been used in this study because they were arrived at after an empirical study was conducted. The objectives of the financial statements compiled by the Trueblood committee can thus be regarded as reflecting the true empirical objectives of preparing financial statements. The committee compiled twelve objectives of financial statements. If, as the literature claims, the accounting discipline is a measurement discipline (e.g. AICPA, 1941; Bierman, 1963; Goldberg, 2001; IFRS, 2006; Wolk *et al.,* 2001), then these objectives should be compatible with the principles of representational measurement. An analysis of the compatibility of the objectives of financial statements with representational measurement is carried out below:

The first objective of the financial statement states (Wolk *et al.*, 2001:182):

> The basic objective of the financial statements is to provide information useful for making economic decisions.

The first objective links accounting information to decision making. It places emphasis on processes external to accounting. This suggests that users of accounting information must understand the perspective of a measurement approach in order to use accounting measurement information.

However, it should also be pointed out that it is not possible for users of accounting information to know with certainty whether such information is useful for a particular decision. Ijiri (1975) notes that decisions are made under conditions of uncertainty. Consequently, it is clear that a decision maker can only estimate the likelihood of an event happening based on his past experience. It is also evident from this that the exact nature of the event cannot be known in advance. Therefore, if the exact nature of the event is not known it follows that the exact nature of the accounting information that is needed to predict the event is also not known with certainty.

It is imperative that the exact use to which accounting information produced for decision-making purposes will be put should be known with certainty. The principles of the representational theory of measurement require that all measurement information be meaningful (Luce and Narens, 1994). If accounting is a discipline that produces measurement information, then accounting information must be meaningful. Churchman and Ratoosh (1959) argue that an empirical hypothesis, or any statement of fact, which uses numerical quantities is empirically meaningful only if its truth-value is invariant under the appropriate transformations of the numerical quantities involved. It can be inferred from this that meaningful statements are so because of the use to which the information may be put. If the use to which this information may be put is not known with certainty, accounting information may not be considered meaningful.

The second objective states (Wolk *et al.*, 2001:182):

> An objective of the financial statements is to serve primarily those users who have limited authority, ability, or resources to obtain information and

> who rely on financial statements as their principal source of information about an enterprise's economic activities.

The second objective identifies the primary audience of the financial statement. The specification of the primary audience undermines the pervasive nature of accounting measurements among all the investors of the business entity and the investors of different business entities. If information is produced for a specific group of people it undermines its comparability among all users of accounting information. The primary audience of the financial statement is clearly identified in the excerpt as those users who have limited authority and resources to obtain information, and those who rely on financial statements as their principal source of information. If the information in these financial statements is intended for the less informed investors it means that the objective of measurement will be biased towards the goals of these investors. This is because measurement presupposes a goal to be achieved (Caws, 1959:3). As a result, the choice of scales to use and attributes to measure in accounting will be biased towards the information needs of less informed users.

The third objective states (Wolk *et al.*, 2001:182):

> An objective of the financial statements is to provide information useful to investors and creditors for predicting, comparing, and evaluating potential cash flows to them in terms of amount, timing, and related uncertainty.

The third objective identifies investors and creditors as the primary users of the financial statement. However, it is not absolutely clear why it is necessary to single out investors and creditors in the light of the Trueblood committee's value judgment that user decisions and information are largely homogeneous (see Wolk *et al.*, 2001). This suggests that there is a lack of clarity in the accounting discipline as to what information should be produced for users.

Nevertheless, since the second objective specifies that financial statements be intended for users with limited ability to obtain information, and states ”An objective of the financial statements is to serve primarily those users who have limited authority, ability, or resource to obtain information and those who rely on financial statements as their principal source of information about an enterprise’s activity”, then it can be inferred that investors and creditors have limited ability in obtaining accounting information. Evidently, the numerical representations of the empirical relations of this information are also biased towards the investors and creditors. The information content of the measures that describe this accounting information is determined by the information needs of the investors and creditors. This makes accounting information useless to users other than investors and creditors.

The third objective also suggests that accounting information should be useful for predictive purposes. This means that the measures that describe the empirical properties of accounting phenomena should be useful for predictive purposes. Ryan *et al.* (2002) point out that predictions can only be made from information that is theoretical. Thus, if accounting information is used for predictive purposes then accounting measurements must be theoretical, and if this information is used for predictive purposes, then there must be a theory of accounting measurement.

The fourth objective states (Wolk *et al.*, 2001:182):

> An objective of the financial statements is to provide users with information for predicting, comparing, and evaluating enterprise earning power.

The fourth objective identifies the uses of financial information as for predicting, comparing and evaluating the enterprise’s earning power. The earning power of a business is determined for a specific period (IASB, 2006). However, the activities of an entity are not stopped to determine its earning power during a particular period. An arbitrary cut-off point is imposed on the business activities, which are otherwise continuous. Moreover, the periodicity of income determination requires

the going concern assumption (Sterling, 1979). This means that the present measurement of income is dependent upon subsequent events. However, measurement occurs at a specific point in time regardless of what happened in the past or what will happen in the future (Sterling, 1979). In other words, present measurements cannot be dependent on past or future events. Consequently, it is clear that income is not currently measurable as it is dependent on future events. This objective is thus not in harmony with the principles of the representational theory of measurement.

The fifth objective states (Wolk *et al.*, 2001:182):

> An objective of the financial statements is to supply information that is useful in judging management's ability to utilize enterprise resources effectively in achieving the primary enterprise goal.

The fifth objective implies that the information contained in financial statements can be used to judge the abilities of management. The objective also highlights the functions of management as extending beyond those of simply safeguarding the assets, to effectively and efficiently utilizing assets in order to carry out the enterprise's objective of maximizing future cash flows. Furthermore, it can be inferred that this objective requires that management be accountable to the investors for the activities of the enterprise and their consequences for these investors.

From this discussion it is clear that this objective implies that accounting information must be measured in accordance with the goals of a specific entity. It follows that the empirical significance and the meaningfulness of accounting measurements should be interpreted with reference to a specific firm. Consequently, accounting information cannot be compared beyond the borders of a specific entity. Baiman (1990) supports this view, pointing out that the rights and responsibilities of the principals and agents are specified in the mutually agreed upon employment contracts. As a result, the production of accounting information

is governed by specific contracts. It is therefore evident that accounting information is relative to a social setting. That is, it describes the relationships within a social setting. Thus, accounting information is not comparable across different accounting entities unless these entities are in an identical social setting.

The sixth objective states (Wolk *et al.*, 2001:182):

> An objective of financial statements is to provide factual and interpretive information about transactions and other events, which is useful for predicting, comparing, and evaluating enterprise earning power. Basic underlying assumptions with respect to matters subject to interpretation, evaluation, prediction, or estimation should be disclosed.

The use of the word "factual" in the sixth objective implies that the information that should be contained in the financial statements should be true, accurate, authentic, historical and genuine. It is not currently possible for accounting systems to provide information that is factual. This is because there is no measurement that is factual or accurate. Measurement is never any more than an approximation. Margenau (1959:136) is very clear about this:

"An empirically true value of a measured quantity does not exist. What passes for truth among the results of measurement is maximum likelihood, a concept that attains meaning if a significant statistical sample of differing measured values is available."

Moreover, the sixth objective of the financial statements does not take into account the agent's involvement with the information (see, Ijiri, 1975:x). As a result the objective tends to encourage subjective information assuming that it is not biased. Furthermore, the financial statements contain book entries (Gouws and Van der Poll, 2004). These authors point out that book entries are a creation of the mind, and not based on observed reality. This suggests that book entries cannot be empirically verified, as they do not represent reality. According to Luce *et al*. (1971), phenomena that cannot be empirically verified are not measurable. Thus, it is clear from this that book entries are not measurable. In addition, the

use of estimates in financial statements also means that the information contained in them is not factual. An “estimate” is a judgment that is made without the exact details or figures about the size, amount and cost of something (Hornby, 2005). Consequently, estimates do not correspond to real world phenomena, and thus they cannot be classified as measurements or as factual. As has been outlined above (Luce *et al.*, 1971), measurements must represent reality and must be a true representation of reality (subject to a specified error) before they can qualify as measurements.

The seventh objective states (Wolk *et al.*, 2001:182):

> An objective is to provide a statement of financial position useful for predicting, comparing, and evaluating enterprise earning power. This statement should provide information concerning enterprise transactions and other events that are part of incomplete earnings cycles. Current values should also be reported when they differ significantly from historical cost. Assets and liabilities should be grouped or segregated by the relative uncertainty of the amount and timing of prospective realization or liquidation.

The statement of financial position contains the values of assets and liabilities. Since the values of assets and liabilities lie in the future (Sterling, 1968), this means that it is not possible to measure the empirical properties of assets in the present. Moreover, the statement of financial position is prepared under the going concern assumption, and as a result the present measurements of the elements of the balance sheet are dependent on subsequent events. This means that the true values of these elements can never be known since subsequent events always lie in the future. In addition, Sterling (1979) points out that measurement occurs at a specific point in time regardless of what has happened before or what is still to come. It is evident from this that past and future occurrences are not relevant to present measurements. Consequently, one can see that it is not possible to have measurements of the values of assets or liabilities in the balance sheet that are dependent on subsequent events. It is clear, then, that the values

of assets and liabilities in the balance sheet do not meet the requirements of measurements. This suggests that the financial reporting requirements of this objective are not in harmony with the principles of the representational theory of measurement.

Classification is fundamental to every measurement system. Mattessich (1964:60) points out that classification is the ultimate basis of measurement. He argues that a class symbol has to be assigned to an empirical object or event initially for measurement to occur. It follows that what is needed for measurement to commence is a qualitative description of the characteristic that is to be measured. A name or an identity has to be assigned to the phenomenon that is subject to measurement for measurement to commence. One can see that such an assignment of identity provides the phenomenon in question with a class.

If assets and liabilities are being grouped by the relative uncertainty of the amount and timing of the prospective realization it means that the attribute that is being measured is the relative uncertainty and timing of the realization. It is therefore evident that value is an attribute of assets and liabilities that is measurable using current values, historical cost or present values, and consequently, it also follows that the “relative uncertainty and timing of the realization of assets or liabilities” is an attribute of the value of assets and liabilities that is measurable by classification.

There is no specification in the accounting literature, however, of the property of “uncertainty“ that is used to classify assets and liabilities in the balance sheet. According to Narens (2002) it is necessary to specify the property that is subject to measurement before measurement can take place. It can be inferred from this that one cannot measure something one does not know. Furthermore, there is no specification of a scale of some kind which makes it possible to distinguish the extent to which assets and liabilities possess the specified property of relative uncertainty. A scale of measuring uncertainty establishes the amount of uncertainty in the realization of the value of an asset or a liability. The absence of

such a scale implies that the amount of uncertainty in the realization of the value of an asset or liability can only be subjective. Consequently, this suggests that it is not possible to measure accounting phenomena under the seventh objective of the financial statements.

In addition, there is no specification of the factors to be considered in determining the relative uncertainty and timing of the realization of the amounts the items in the statement of financial position have in common. In fact, in the current accounting literature, there is no clear stipulation of the financial properties of objects and events which decision makers can properly use to make judgments about or legitimate comparisons between particular companies. It is necessary to give a precise identity to what is being compared so that a standard for such comparisons can be established. Therefore, this objective suggests that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement.

The eighth objective states (Wolk *et al.*, 2001:182):

> An objective is to provide a statement of periodic earnings useful for predicting, comparing, and evaluating enterprise earning power. The net result of completed earnings cycles and enterprise activities resulting in recognizable progress toward completion of incomplete cycles should be reported. Changes in the values reflected in successive statements of financial position should also be reported, but separately, since they differ in terms of their certainty of realization.

The objective points out that the preparation of a statement of periodic earnings is necessary in the evaluation of the earning potential of an enterprise. According to Sterling (1979), the income statement specifies a particular time interval. In the income statement, economic effects of different economic events that occur at different points in the time interval are aggregated to determine the earning power of the business during that particular time interval. It is debatable however, whether the figure of periodic earnings arrived at can be considered to be a

measure of anything. Sterling (1979:223) points out that measurement occurs at a specific point in time regardless of what has happened before or what will happen after that specific point in time. This indicates that measurements should take into account events that are occurring at that specific point in time. It is thus evident that the aggregation of the economic effects of different economic events that have occurred at different points in time to determine periodic earnings is not in harmony with the concept of measurement.

The objective also indicates that the preparation of a statement of financial position is necessary for the determination of the financial health of a company at a specific point in time. The statement of financial position contains the values of assets and liabilities. Sterling (1968) notes that statements prepared under going concern are provisional and dependent on subsequent events. Therefore, one can infer that the values of the assets and liabilities in the statement of financial position are dependent on subsequent events. Since it has been noted above (Sterling, 1979) that measurement occurs at a specific point in time regardless of what will happen in the future, this implies that the values of the assets and liabilities in the balance sheet cannot be measurements. They are dependent on events that have not yet occurred. For this reason, they are not compatible with the principles of representational measurement.

Furthermore, it is alleged that the true income of a firm cannot be calculated until the firm is dissolved (Sterling, 1968). This means that all the values prepared under the going concern assumption are provisional. Under going concern income can never be determined. The aspect of comparability cannot be achieved since the true values of the elements of the financial statements are not known under going concern. As outlined earlier, all measurements occur at a specific point in time, and so the dependence of the value of income on subsequent events does not reflect the qualities of a measurement.

The ninth objective states (Wolk *et al.*, 2001:182):

> Another objective is to provide a statement of financial activities useful for predicting, comparing, and evaluating enterprise-earning power. This statement should report mainly on factual aspects of enterprise transactions having or expected to have significant cash consequences. This statement should report data that require minimal judgment and interpretation by the preparer.

The objective asserts that the aim of the financial statements is to provide a statement of financial activities that reports factual information on the activities of the enterprise. This means that the statement intends to convey objective information. However, this is not possible since financial statements are prepared on the going concern basis. Information prepared on the going concern basis is dependent on subsequent events (Sterling, 1968), and subsequent events are always in the future and can never be known.

The ninth objective consistently uses of the term “factual”. This term is not consistent with the concept of measurement. Measurement is never anything more than an approximation (Larson, 1969). All measurements involve an element of error. An empirically “true” value does not exist. What passes for truth among the results of measurement is maximum likelihood; a concept that attains meaning if a significant statistical sample of differing measured values is available (Margenau, 1959). This implies that measurements do not reflect the truth, but only approximations of the truth. This objective suggests an exactness of accounting quantifications that is not in harmony with the principles of measurement, indicating that the ninth objective is not in harmony with the principles of the representational theory of measurement.

The tenth objective states (Wolk *et al.*, 2001:182):

> An objective of the financial statements is to provide information useful for the predictive process. Financial forecasts should be provided when they will enhance the reliability of user's predictions.

This objective points out that the information in financial statements must have predictive powers. In order to be able to predict phenomena, one must have empirical information about the phenomena in the present. Sterling (1968) notes that financial statements prepared under the going concern basis are provisional and that the information in these statements is dependent on subsequent events. It is clear then from this that the present magnitude of information in financial statements cannot be known because subsequent events always lie in the future and cannot be known. It is clear from this that the information contained in financial statements does not represent objectively existing entities. Furthermore, for information to have predictive powers it must be theoretical. According to Churchman and Ratoosh (1959), the function of a theory is to summarize information about empirical phenomena and predict the behaviour of the phenomena. In other words, the purpose of a theory is to explain the future behaviour of a phenomenon and to provide dependable information about it. However, the information contained in financial statements cannot be theoretical as it is dependent on future events. Thus it does not correspond closely to real world phenomena.

The eleventh objective states (Wolk *et al.*, 2001:182):

> An objective of financial statements for governmental and not for profit organizations is to provide information useful for evaluating the effectiveness of the management of resources in achieving the organization's goals. Performance measures should be quantified in terms of identified goals.

This objective highlights the point that financial statements should provide information to enable users to judge the performance of an entity. McLean (2006) points out that the performance is always measured in relation to some point of

reference. In this case it is in relation to some identified goals. Each organization has its own goals. Different organizations might choose different reference points for the evaluation of performance. Furthermore, if the organization has multiple stakeholders, it is possible that they could adopt different reference points for determining the performance of an entity. It is important to note that the property that is of use and interest to measure in determining performance must be specified and it must be measurable. However, authors such as Chambers (1997), Ryan *et al.* (2002) and Staubus (2004) note that the property that is of use and interest to measure in the accounting discipline is not specified. It follows that although this objective specifies the need to measure performance, the accounting discipline has not as yet developed a system of determining performance that meets the requirements for performance measurement.

The twelfth objective states (Wolk *et al.*, 2001:182):

> An objective of financial statements is to report on those activities of the enterprise that affect society which can be determined and described or measured and which are important to the enterprise in its social environment.

This objective places emphasis on the interaction between the private goals of shareholders and the goals of the public as a whole. It is evident from this objective that the goals of a business enterprise that are important to its social environment should be congruent with those of society. The objective also points out that the enterprise must take into account only those objectives that are important to it in its social environment, and not those goals that are important to the society in its social environment. It is clear, then, that it is the business enterprise that determines which activities are important to its social environment and not the society.

The objective also points out that the activities that the firm perceives as affecting its social environment, which must be reported by the entity, must be capable of

being described, determined and measured. The use of the term “described” implies that it should be possible for the enterprise to give a qualitative account of that which influences the social activities of the firm. Furthermore, the use of the term “determined” by the objective implies that these activities should be capable of being empirically verified. The use of the term ”measured” in describing the economic activities implies that the attributes of the activities the enterprise perceives as affecting its social environment should be capable of being represented by a numerical relational system in a way that can be empirically verified.

The twelfth objective also suggests that it is possible for measures of the attributes of those activities that the enterprise perceives as affecting its social environment to be common among the management, the shareholders and the society. However, if the choice of the measures of the attributes of the enterprise that affect society depends on the entity, then the public has no say in what may be reported by the entity. Ijiri (1975:ix) points out that the management is involved with the information and cannot report negatively on their activities. Worse still, the public does not provide any input in the production of the information they receive. Consequently, the public might have a different reference point for determining what are satisfactory measures of those activities that affect the enterprise’s social environment, and what are not. It can be concluded from this that society does not have a say on what the firm chooses to report and describe.

3.5-Summary and Conclusions

The accounting literature points out that the concept of measurement is fundamental to the preparation of financial statements. It can also be concluded from this chapter that the accounting literature is very clear that the preparation of financial statements is not possible in the absence of measurement. It has also been indicated in the literature that the attributes that are of use and interest to measure are value or cost. The definition of accounting also suggests that measurement is an indispensable part of accounting.

However, in spite of the literature suggesting that measurement is an indispensable part of accounting, an analysis of the definition, purpose and objectives of accounting indicates that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement. Some of the main points are recaptured below:

- Accounting literature implies an accuracy of accounting measures that is inconsistent with the concept of measurement. The accounting literature purports that it is possible to be accurate and factual. But measurement literature points out that there are no accurate measurements. Measurement is never anything more than an approximation. All measurements contain an error of some sort. Accounting measurements do not reflect the concept of error. This should be specified in accounting measurements.
- There is no specification of the objects or the properties of objects which are the subject of measurement in accounting. Value or cost does not have a precise definition in accounting. This is inconsistent with the principles of the representational theory of measurement that require that the object of measurement must be empirically identifiable and testable.
- The objectives of the financial statements specified in the accounting literature are vague and subject to interpretation. This indicates that accounting measurements are not independent of particular places and factual occurrences. This means that accounting measurements are hardly common beyond the boundaries of a specific entity. It follows, then, that accounting information in financial statements explains the unique economic events that occur within a business entity.

The discussion in this chapter has pointed out that the principles for preparing the financial statement are based on the premise that accounting is a measurement discipline. It has also been noted that the definition of accounting implies that it is a measurement discipline. However, this definition implies an exactness of

accounting measurements that is not consistent with the principles of measurement. Furthermore, the objectives of financial reporting are not in harmony with the principles of representational measurement. It can thus be concluded that if accounting is to be considered a measurement discipline, its objectives and its definition should be constructed in such a way that they are consistent with the principles of measurement.

Chapter 4-The concept of a scale in accounting measurement

4.1-Introduction

The concept of a scale is an indispensable part of measurement. Every measurement process has to specify a scale in order for it to be described as a process of measurement (Ryan, et al, 2002). Accounting is considered to be a measurement discipline (e.g. AICPA, 1941; Bierman, 1963; and IFRS, 2006). Consequently, one would expect to find scales of measurement in accounting. However, authors such as Staubus (2004), Ryan *et al.* (2002), Chambers (1997) and Willet (1987) have all pointed out that there is no specification in the accounting discipline of a scale of any kind which makes it possible to distinguish the extent to which every object in a specified class of accounting phenomena possesses a specified property. This suggests that accounting is not a measurement discipline.

In chapter 1 it was noted that there is consensus that researchers in the field of accounting have not yet managed to create a comprehensive and coherent theory of measurement from the observation of accounting measurement practices. Narens (2002) makes the point that a theory of measurement consists of a precise specification of how a scale is formed. Consequently, the lack of success in creating a comprehensive and coherent theory of measurement in accounting suggests that researchers have not succeeded in creating a comprehensive and coherent specification of how a scale of measurement is formed in accounting. The establishment of scales can be considered as part of the foundation of measurement.

The principles of measurement fit better to the degree that the dimensions and qualities of the things that are being studied are measurable on well-founded scales (Stevens, 1951). The reason for determining the nature of the application of the concept of a scale in accounting originates from the fact that accounting is

considered to be a measurement discipline, while accounting theory has not specified a comprehensive and coherent theory of measurement for this discipline.

The representational theory of measurement offers an abstract theory of the kinds of well-behaved scales that one encounters in science. Stevens (1946, 1951) placed great emphasis on the uniqueness of representations. Stevens' scale types, namely ordinal, interval, ratio and nominal, had most empirical examples from representational measurement falling within this list. But Stevens' (1951:25) list of scales is not exhaustive. Narens (1981a, 1981b) shows that there are scales between the ratio and interval scales. However, none of these scales has yet played a role in actual scientific measurement (Luce, and Suppes, 2001). This means that the scales between the interval scale and the ratio scale have not yet been developed to the extent that they can be used in actual measurement. For this reason, the discussion of scales in this study is limited to Stevens' (1951) list outlined above.

The fact that there is no acceptable theory of accounting measurement suggests that the inclusion of the word "measurement" in accounting has preceded any thoroughgoing analysis of measurement's essential meaning and corresponding implications for the discipline. The introduction of the term "representational measurement" to accounting prior to the analysis of its more general, scientific connotation tends to impose upon representational measurement the meaning of traditional accounting methodology. If this is the case, the deficiencies in the application of the concept of the scale to accounting have to be inferred from the perception of accounting as an explanatory discipline that utilizes representational measurement as its primary mode of description.

The purpose of this chapter is to investigate whether the application of the concept of a scale in the accounting discipline conforms to its more general scientific connotations. Because accounting is considered to be a social science (see, chapter 1), the theory of measurement that is applicable to it is the

representational theory of measurement (Scott and Suppes, 1958; Stevens, 1946, 1951; Suppes, 1951; Suppes and Zinnes, 1963). Therefore, the nature of the application of the concept of the scale to accounting is investigated from the perspective of the representational measurement theory.

This chapter begins with a discussion of the concept of scale and its uses in measurement in section 4.2. A discussion of the significance of the concept of a representational scale to accounting is provided in section 4.3. The properties of nominal scales are discussed in section 4.4, followed by a discussion of the application of the properties of an ordinal scale to accounting in section 4.5. In section 4.6 a discussion of the applicability of the properties of the interval scale is provided. The current applications of the ratio scale in accounting are discussed in section 4.7. The conclusions close the study in section 4.8.

4.2-The concept of a representational scale

The concept of a scale is of fundamental importance in measurement literature. Stevens (1951) describes a scale as a rule for the assignment of numerals to properties of objects or events. This perspective equates a scale to a specific method of measuring. If a scale is equated to a specific way of measuring, it means that every measurement process must have a rule of measurement. This is because the process of measurement always occurs in a specific way. Furthermore, the definition of measurement implies that no measurement can take place in the absence of a scale. For example, Stevens (1951:1) refers to the presence of a scale in every measurement process when he states, “In its broadest sense measurement is the assignment of numbers to objects according to rules.” In other words, in a process of measurement numbers are assigned to objects in a controlled way. The use of the term “rule” implies the presence of a statement that specifies what must be done in a particular process of measurement. It is clear that in a process of measurement the random assignment of numbers to objects is excluded. Luce *et al.* (1971) notes that measurement can only take place if the rule that maps an empirical relational

structure onto the numerical relational structure is specified. Thus the process of measurement only takes place in the presence of a standardized rule of measurement. Therefore, if the term “rule” in the above quotation is taken to mean the presence of a scale in every measurement process, then it is reasonable to conclude that every process of measurement must have a scale of measurement.

Similarly, Narens (2002: 757) defines a scale as follows:

“**S** is said to be a representational scale if and only if there exists a qualitative structure **X** and a mathematical representing structure **N** for **X** such that **S** is a subset of one-to-one homomorphisms from **X** to **N.**“

This extract points out that a scale of measurement can only exist when there is a qualitative structure that can be represented by a numerical relational structure. It is also clear that a scale is part of the homomorphisms that map a qualitative structure onto a numerical relational structure. In chapter 2 it was noted that a homomorphism is a function that maps an algebraic structure onto another in a way that preserves the properties of the algebraic structure that is being mapped. It is evident from this that a scale indicates the relationship that enables a qualitative structure to be mapped onto a numerical relational structure. It follows, therefore, that a scale explains how the properties of a qualitative structure are represented by an algebraic structure. Thus, it can be concluded that a scale is a rule that explains the representation of an empirical relational structure by a numerical relational structure.

The rules of measurement that create a scale are subject to arbitrary conventions. Luce *et al.* (1971) point out that the scales of measurement are subject to arbitrary conventions. It can be argued from this that scales of measurement are socially constructed. This suggests that each process of measurement has its own rules of measurement. That is, some societies may agree to use inches to measure height and while other societies may agree that height should be measured in metres. As a result, there is the possibility of a proliferation of rules of

measurement for a single process of measurement. Stevens (1951:1) refers to the possible proliferation of measurement rules when he states,

> And the fact that numerals can be assigned under different rules leads to different kinds of scales and the different kinds of measurements.

These words underline the fact that there is no one method of measuring, but many. These numerous methods of measurement lead to different kinds of scales. Luce *et al.* (1971) points out that scales of measurement are subject to arbitrary convention. If this is so, each frame of reference can have its own rules of measurement. It can also be inferred that the type of scale distinguishes one form of measurement from another.

It should also be noted that the rules of measurement are not part of the phenomenon that is being measured. The empirical relational structure and its empirical properties is not a matter of convention (Luce *et al.*, 1971). Luce *et al*. (1971) also argue that the empirical relational structure and its empirical properties should be treated as a set of qualitative empirical laws. This means that the phenomenon that is being measured should be invariant under any set of measurement procedures. A set of measurement procedures does not change the underlying property it is measuring (e.g., the height of a man is not changed by a metre rule used to measure it).

Stevens (1951) characterized scales into four types, namely, nominal, ordinal interval and ratio scales. These types are also applicable to accounting (see, Section 4.3). The type of scale achieved in measurement depends upon the character of the basic empirical operations performed on the property that is being measured. These operations are limited ordinarily by the peculiarities of the thing being scaled and by our choice of the concrete procedures but, once selected, these procedures determine the type of scale that will eventuate (Stevens, 1951). The type of a scale indicates the level of measurement. Associated with each level of measurement is a set of mathematical operations that may be performed

on a measure. Each level of measurement involves different properties (relations and operations) of the numbers or symbols that constitute the measurements.

The mathematical operations that may be performed on a measure without changing its meaning are termed permissible transformations on the scale. Permissible transformations are defined as transformations of a scale of measurement that preserve the relevant relationships of the measurement process (Luce *et al.,* 1971). For example, changing the unit of measurement of distance (say, from inches to centimetres) multiplies the measurements by a constant factor. This multiplication does not alter the correspondence of the relationships “greater than” or the correspondence of addition and concatenation. Hence, it follows that the change of units is a permissible transformation with respect to these relationships.

A scale of measurement exists only if an underlying theory of measurement exists. Narens (2002) asserts that a theory of measurement consists of a precise specification of how a scale is formed. This means that no scale of measurement can exist without an underlying theory of measurement. Narens (2002) also defines a scale on an empirical relational system as a nonempty set of functions from the empirical relational system into the numerical relational system. Thus, a scale is said to be a representational scale if and only if there exists a qualitative structure and a mathematical representing structure such that the scale is a subset of one-to-one mappings from the qualitative structure into the numerical structure.

The concept of a representational scale is inextricably linked to the uniqueness and the existence theorems of representational measurement. A number assigned to measure a property is unique once a unit of measurement has been chosen (Churchman and Ratoosh, 1959). This means that a scale of measurement makes a measure unique. Vickrey (1970) also notes that the proof of the uniqueness theorem is equivalent to identifying all possible scales for the measurement of the elements of a given empirical relational system. This means

that the type of measurement can be known if and only if the scales of measurement are known.

4.3 The significance of the concept of a representational scale in accounting

Different scales of measurement exist that may be applicable to accounting. Mattessich (1964:63) identifies the scales of measurement in accounting as the nominal scale, ordinal scale, interval and ratio scales. The classification of scales into scale types is based on the amount of information about a property that is contained in a scale (Stevens, 1951). This suggests that every measurement scheme should specify the type of scale used in order to indicate the amount of information contained by the measures it produces. It can also be inferred from this that a scale of measurement is an embodiment of the properties of the phenomenon that is being measured. Without the specification of a scale of measurement it would be not possible to know what a particular numerical assignment represents.

The accounting discipline is regarded as a measurement discipline (Wolk *et al*, 2001; IFRS, 2006). If this is true, it would mean that the accounting discipline should be capable of specifying the rules of measurement employed in its measurement processes. However, authors such as Chambers (1997:38), Ryan *et al.* (2002:118) and Staubus (2004) point out that in the accounting literature there are no specified scales of measurement that can be used to assign numbers to the attributes of accounting phenomena. This calls into question the status of accounting as a measurement discipline. The lack of specified scales of measurement in accounting suggests that the amount of information contained in measures of the attributes of accounting phenomena is not known.

Measurements are about stating the relationship between the numerals and the objects. A rule of measurement states the relationship between the numerals and objects (Boyce *et al.*, 1994). This means that the lack of success by the accounting researchers in specifying the rules that distinguish the extent to which

accounting objects in a particular class possess a particular property implies that the relations between the numerals and objects are not known. If these relations are not known it would be difficult to determine the meaning of a measurement. It follows that the concept of a scale influences the meaningfulness of a measure.

The concept of measurement suggests a connection between the meaning of a measure and the scale of measurement used in producing this measure. This is reflected by Chambers (1997:38):

> In the third place, every measurement scheme requires the specification of the unit in the scale, and the conditions under which unit measurements shall be deemed to be of equal significance. In brief, this requires specification of the meaning of the "standard" unit. This is necessary since measurements may be taken in a variety of non-standard situations, such that the raw or crude measurements are not comparable or addable.

This indicates that a scale used in a process of measurement must be specified. The extract also points out that measurements are empirically significant in the presence of a specified scale of measurement. A scale of measurement specifies the conditions under which a measurement has been made. It is clear then from this extract that the essence of meaningfulness is embodied in the description of the scale type and permissible statistics. This also highlights the fact that the statistics that can be performed on a measure lead to the formation of meaningful, or meaningless, statements based on measurements made on those scales. The meaning of a measure is thus embodied in the description of the meaning of the standard unit. It can thus be concluded that the lack of specified scales in accounting implies that accounting measurements lack meaning and should not be compared unless a scale of measurement is specified.

Nevertheless, accounting information is compared in the accounting discipline in the absence of specified scales of measurement. For example, IASB (2006: Para

39) clearly states the need for accounting information to be comparable as follows:

> Users must be able to compare the financial statements of an entity through time in order to identify trends in its financial position and performance. Users must also be able to compare the financial statements of different entities in order to evaluate their relative financial position, performance and changes in financial position. Hence the measurement and display of the financial effect of like transactions and other events must be carried out in a consistent way throughout an entity and over time for that entity and in a consistent way for different entities.

The extract suggests that it is possible for users of accounting information to compare information from different entities in the absence of specified scales of measurement. Furthermore, the excerpt mentions the measurement of the attributes of financial transactions, but there is no specification of the scale of measurement. This highlights the existence of a belief in the accounting discipline that it is possible to measure a phenomenon in the absence of a specified scale of measurement. Added to this, accounting researchers (e.g. Ryan *et al.*, 2002; Staubus, 2004) have not succeeded in establishing a scale of measurement. It can be concluded from this that the concept of a scale of measurement is not recognized in the accounting discipline.

The nature of accounting measurements demands that the scales of measurement should be specified before they are compared. Accounting measurements are dependent on the intuition of the accountant. It follows that the procedures employed in measurement are dependent on this same intuition, as are the scales of measurement in accounting. Mattessich (1964:79) refers to the dependence of accounting measurements on the intuition of the accountant when he states:

> There neither exists at present the possibility to infer accounting values through “natural laws” (i.e., by fundamental measurement) nor through a combination of two or more fundamental measures that result in derived measurement. Most of the economic and accounting measures belong in the category of measurement by fiat, which is reflected in a certain definitional arbitrariness of our discipline.

This emphasizes the fact that accounting measurements are dependent on the intuition of the accountant. It also indicates that accounting is not a natural science but a social science. The use of the phrase “definitional arbitrariness of our discipline” implies that accounting definitions are not based on consistent rules or plans, but are dependent instead on the context in which they are used. It is clear then that accounting measurements are socially constructed. Consequently, this suggests that there is a need to clearly specify the nature of the social context of accounting measurements before they are evaluated. There could be a difference between the kinds of assigning of numbers arising from different procedures of measurement. If a scale of measurement is not specified in a measurement discipline, it is not possible to tell whether there are any other numbers that can be assigned as measures of the same property. Such knowledge of other numbers that might be assigned is important in determining the uniqueness of a measure. The number assigned to measure a property of an object is unique once a unit has been assigned to it (Churchman and Ratoosh, 1959). This means that the concept of a scale is also important for the quality of uniqueness of measures. A lack of specified scales of measurement implies that the uniqueness of numbers assigned to represent the properties of accounting objects cannot be determined.

The lack of success of researchers in the accounting field in specifying the scales of measurement has negative implications for the mathematical operations that could be carried out on accounting measurements. Chambers (1997) contends that the scales of measurements (or rather measurements taken in them) have

different mathematical characteristics. He also suggests that the addition of measures and other forms of relations (subtraction, multiplication, division, etc.) is common in accounting processes. As a result it is necessary to consider the conditions under which addition (and other forms of relation) is mathematically permissible (e.g., the addition of different classes of assets). That is, the values of assets and liabilities are added in the balance sheet and in the income statement without first verifying whether these measurements have been made under the same scale of measurement. It is necessary to verify whether the values of the items in the financial statements have been made under the same scale of measurement.

The lack of specified scales causes inconsistencies in the classification of measures in accounting. Chambers (1997:39) notes the following on the classification of measures by the AAA's (1971) report on the foundations of accounting measures:

> Among examples of primary measures are counts of physical quantities, and prices of non-monetary goods. In respect of prices, it is said that they may be past, present or future prices. No such stipulation is made in respect of physical counts. Either, therefore, counts and prices are not members of the same class of measures (i.e. primary measures), or both should be treated in the same way (i.e., it should be allowed that physical counts may be past, present or future counts).

The passage above points out that accounting measures that are different are grouped in the same class and that physical counts and prices are regarded as measures of the same property. It is also clear that there is no specified property that is represented by physical counts or by prices. Furthermore, there is no specification of the scale of measurement that could be used to distinguish the extent to which physical counts and prices possess a particular property. Consequently, it is not clear whether physical counts and prices are measures of the same property. This leads to incorrect classification of measures. In this way,

the lack of specified scales in accounting casts doubt on the current belief in the literature that accounting is a measurement discipline.

The individual scales are, however, implied in the literature. This literature contains attempts by researchers in the accounting field (Staubus, 2004; IFRS, 2006; Wolk *et al.*, 2001) to use the concepts of the individual scales of measurement when measuring the attributes of accounting phenomena. An assessment of the applications in the discipline of accounting of the principles of the various scales that were highlighted by Stevens (1951) is provided in the sections that follow.

4.4 The application of the concept of the nominal scale in accounting

A nominal scale is the most basic scale of measurement. It is a simple classification or labelling system (Stevens, 1951). This suggests that only symbolic representation is necessary for measurement to occur under a nominal scale. Luce *et al.* (1971) note that the numbers in a nominal scale reflect the objects themselves, rather than their properties. This means that no mathematical operations may be performed on the numbers in a nominal scale. Since the only quantification is the number count of cases in each category (the frequency distribution), the researcher is restricted to the use of the mode as the measure of central tendency (see Stevens, 1951). Hence, the nominal scale should be considered as having limited arithmetic properties.

The nominal scale is commonly used in the accounting discipline. The activity of classification in accounting arises from the need for a tight net of a large number of concepts (Mattessich, 1964). Accounting phenomena are classified 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 or that they can be added. Nowhere in the accounting literature does it state or imply that

mathematical operations of any kind can be performed on the classified transactions. However, there are instances in this literature where it is not clear whether the nominal scale has been used to effect the mathematical operation of addition. For example, IAS 1 (2006, Para 88) states:

> An entity shall present an analysis of expenses using a classification based on either the nature of expenses or their function within the entity, whichever provides information that is reliable and more relevant.

This indicates that expenses shall be classified in the financial statements according their nature and function. Since, as has been outlined above (Stevens, 1951), the nominal scale is a simple classification system, it can be inferred from this that the classification of expenses based on their nature and function implies the use of a nominal scale. Furthermore, IAS 1 (2006, Para 91) also states:

> The first form of analysis is the nature of expenses method. Expenses are aggregated in the income statement according to their nature (for example, depreciation, purchases of materials, transport costs, employee benefits and advertising costs), and are not reallocated among various functions within the entity.

An analysis of this passage indicates that expenses may be classified according to their nature, but it does not mean that the monetary amounts of the individual expenses are representatives of an identical attribute of expenses under the same classification. A statement that clearly indicates that the monetary amounts are representatives of identical attributes of expenses under the same classification is necessary, and the attribute must be specified. Nowhere in the IAS 1 (2006) is there any discussion of the attribute, which the monetary amounts of expenses under the same classification represent, either in general terms, or in terms appropriate for their aggregation in the income statement. Willet (1987) notes that it is not known exactly what the amount of monetary units represent in accounting. Researchers such as Vickrey (1970) and Ryan *et al.* (2002) have concluded that there is no property which is measured by the financial statements apart from the

numerosity of monetary units. This leads to the conclusion that the nominal scale in this case is used to imply the operation of addition. Therefore, in this case, it follows that the nominal scale has been accorded qualities that are beyond identity and difference.

But in defence of the prescriptions of IAS 1 (2006), it may be contended that classification can be considered a form of measurement for a monothetic class. A monothetic class is one in which each member possesses all the properties that define the class. If addition is to be implied, then each member of the class must have all the properties that define that class. However, nowhere in IAS 1 (2006) is there any discussion of the properties that expenses which fall under the same classification should have. This leads to possibility that each member of the expenses that falls under the same classification might possess a large number, but not necessarily all, of the properties that define that class. Consequently, classes in which expenses are classified in the financial statements might not be monothetic classes. Thus, one cannot easily imply addition without first verifying whether it is possible to add in a given set of circumstances. It can also be inferred that in spite of the attempt by accounting researchers to use the nominal scale in the classification of accounting phenomena, they have not fully utilized the concept of the this scale. This suggests that the concept of measurement might not be part of traditional accounting methodology; otherwise the accounting discipline would have ensured a proper development of this concept in accounting.

4.5 The application of the concept of the ordinal scale in accounting

The concept of the ordinal scale has its foundations in the concept of order. Order is the arrangement of things according to a particular sequence or method (Hawker, 2003). It is a relationship that has certain characteristics among members of a well-defined set of items (Boyce *et al*., 1994). To be an order the relationship must hold in only one direction when viewed relative to two members of the set (Stevens, 1951). This means that in all measurement instances that

involve the ordinal scale it is necessary to specify the property that is used to order empirical phenomena and the direction of the order. An ordinal scale is thus unidirectional.

The function of an ordinal scale is to assist in the determination of greater or lesser, such as the grades of wool or street numbers (Luce *et al.*, 1971). It is an order of preference system. For a relationship to be an order relationship it must first be asymmetrical (Boyce *et al.*, 1994). This means that an order relationship can hold in only one direction when it is viewed relative to two members of the set. That is, the relationship always looks the same irrespective of the angle it is viewed from. Therefore, an ordinal scale can be defined as a rule that describes an asymmetric relationship. The use of the concept of the ordinal scale in the accounting discipline is evident, even though it is misapplied. For example, IAS 1 (2006: Para IN8) states:

> The Standard requires an entity to present assets and liabilities in order of liquidity only when a liquidity presentation provides information that is reliable and is more relevant than a current/non-current presentation.

This shows that the property “liquidity” is used to differentiate assets and liabilities in the balance sheet into a hierarchy. The position of an asset or a liability in the balance sheet hierarchy of assets or liabilities indicates its liquidity. The property of liquidity must therefore be unidirectional among current assets for an ordinal scale to exist.

And, IAS 1 (2006: Para 51) also states:

> 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 asserts the need to discriminate between assets and liabilities in the financial statements in order of liquidity. It can be inferred from the extract that the classification of assets or liabilities in increasing or decreasing order of liquidity implies the use of the ordinal scale. However, the numerals that specify the extent of the property of liquidity in a current asset or a current liability are not provided. The absence of these numerals is in contrast to principles of measurement.

According to Stevens (1951), measurement is the assignment of numbers to objects according to rules. In a process of measurement numbers must be used to represent the properties of empirical phenomena. In this case no numbers are assigned to the property of liquidity. Yet, liquidity is classified as a measurable property. Furthermore, the property of liquidity itself cannot be empirically verified. However, all measured phenomena must be empirically verifiable. It is clear, therefore, that this is in contrast to the principles of the ordinal scale.

Mattessich (1964:59) outlines the principles of the ordinal scale as follows:

> The ordinal scale consists of classes that are characterized by numerals which are subject to order ranking in conformity with the numerals assigned. The numbers not only serve the mere purpose of designation, but also have a normative or preferential significance. It enforces such an order ranking and thus creates a hierarchy of classes. It is this order ranking which some scholars consider the decisive criterion of measurement.

This extract emphasizes that every ordinal scale should assign numbers to the property of the objects in a class in order for these objects to be ordered in accordance with how much of the property they possess. An order relationship is a relationship that holds in only one direction. It follows that a relationship that holds in more than one direction cannot create an order. Thus, it can be inferred from this that the lack of numbers reflecting how much of the property of liquidity each component of current assets or liabilities possesses implies that the structure and calibration of the ordinal scale ordering current assets or liabilities

according to the property of liquidity is not at present known in accounting. In chapter 2 it was noted that a measure is meaningful if the scale of measurement is known. It was also established that a measure can only be considered meaningful if the transformations that leave its scale of measurement invariant are known. It would thus seem that it is currently impossible to establish any order preserving transformations that will leave the unknown scale of liquidity among current assets or liabilities invariant.

Luce *et al.* (1971:38) make the point that any finite simple order can be represented by a finite set of real numbers together with their natural ordering. The set of current assets or liabilities in the balance sheet is finite. It is therefore necessary to specify the numbers that represent the liquidity of these assets or liabilities in the balance sheet if an ordinal scale is to be established.

A lack of numbers indicating liquidity makes it difficult to prove the attributes of the relations that define order. Stevens (1951:14) identified these attributes as connectedness, asymmetrical and transitivity. These characteristics are discussed below:

- Connectedness- The concept of connectedness is fundamental in defining order in a relation. A relation is connected when, given any two terms of its field, the relation holds between the first and the second or between the second and the first (Russell, 1920:33). That is, in a series of items, if any two are chosen there is a relation that holds between them. A relation has to be connected in order to arrange the elements of a set into a hierarchy. For example, a relation of greater than in a series of natural numbers implies that if any two different items are selected, one of them is greater than the other (Stevens, 1951:12). It is therefore necessary to know the connectedness of the relation of liquidity among current assets. If current assets are arranged in order of increasing liquidity in the balance sheet, and two different current assets are chosen, then it should be shown that they are of differing liquidity.

- Asymmetrical- An asymmetrical relation is a relation that holds in only one direction. For example, relationships such as greater than (if y >x then x is not greater than y), father of, or successor to (Stevens, 1951:13). It must be shown that order holds in one direction only. If the relation were to hold in more than one direction it would not be possible to establish the hierarchy of elements in a set. Therefore, if current assets are arranged in order of increasing liquidity in the balance sheet, then it should mean that current assets that are high up in the series have a liquidity greater than that of current assets that are lower in the series. For example, in the balance sheet it should be empirically shown that cash is more liquid than stock.

- Transitivity- The concept of the transitivity of relations is embedded in the concept of relations in abstract algebra. A transitive relation holds on more than two elements of a set without the elements having to be directly related. Bhattacharya *et al.* (1986:10) describes a transitive relation as follows: "Let **R** be a transitive relation on a set **X**. **R** is said to be transitive if x **R** y and y **R** z imply x **R** z for all x, y, z is an element of **X.**"

This definition suggests that if x is related to y, and y is related to z in the same way it is related to x, then x and z are related. Such a relationship is a transitive relationship. Transitivity is necessary in the determination of order in a relationship. The transitivity of a relationship should be empirically testable. If current assets are arranged in order of increasing liquidity in the balance sheet, it should mean that liquidity as a relation among current assets is transitive. That is, if the liquidity of cash is greater than that of debtors, and the liquidity of debtors is greater than that of stock on hand, then it should be shown that the liquidity of cash is greater than that of stock for liquidity to be transitive.

However, the lack of a scale of measurement that reflects the extent to which different current assets possess the property of liquidity means that the connectedness, asymmetry and transitivity of liquidity among current assets cannot be proved. If this is the case, then an ordinal scale cannot exist. The

discussion above suggests that the concept of the ordinal scale is misapplied in the discipline of accounting.

4.6 The application of the concept of the interval scale in accounting

The concept of the interval scale has its foundations in the equality of intervals. Stevens (1951) explains that the interval scale is quantitative in the ordinary sense of the word, and that all the usual statistical measures apply, unless they are the kinds that imply knowledge of a true zero point. It is evident from this that an interval scale has an arbitrary origin and that one may make all kinds of numerical statements about the interval scale apart from those that imply a true origin. Boyce *et al.* (1994) also refer to the arbitrary origin of the interval scale when they point out that all that is required in an interval scale is a point of origin and a unit of measurement. In accordance with the theory of the hierarchy of scales, the interval scale includes both the nominal scale and the ordinal scale (Stevens, 1951). In addition to its own extra properties, the interval scale includes order and classification. It is clear, then, that the interval scale includes classification, order and the equality of intervals.

The interval scale is concerned with the distance between or the closeness of two elements in a set (Boyce *et al.*, 1994). This means that the value of the intervals between two elements in a set is the sum of the values of those intervals. In the following discussion applications of the interval scale by leading academics and professionals in the field of accounting is discussed. Wolk *et al*. (2001:9) illustrate the use of the interval scale in accounting as follows:

> Thus, in accounting, both $100,000 of current assets divided by $50,000 of current liabilities and $200,000 of current assets divided by $100,000 of current liabilities indicate twice as much current assets as current liabilities.

This means that the monetary amounts that represent current assets can be divided by those that represent current liabilities to give the current ratio. This

division indicates that a relationship is implied between the value of current assets and the value of current liabilities. It is also clear from this extract that current liabilities indicate amounts to be paid. The measure of the value of current assets represents what is available, in money or approximate money's worth, to pay off those liabilities. In order to cover the current liabilities a measure of insolvency is sought. In order to make an assertion that there are twice as many current assets as current liabilities, one has to be sure that there is equality of ratios between the properties that are subject to division. Therefore, if there are twice as many current assets as current liabilities there is an implication that the value of current assets is identical to the value of current liabilities.

However, authors such as Stamp (1981), Tinker (1985) and McLean (2006) point out that value is a subjective concept that is not an intrinsic property of an accounting entity. It is evident that currently in accounting, the empirical properties of value are not known, and that the measurable properties of value are unknown as well. Therefore, it is not true to imply the equality of ratios between the concept of value of an asset and the concept of value of a liability when the value is not known. Nor is it verifiable to assert the existence of a true zero point on an unknown scale of value measurement. That is to say, it is not true to assert that value is measurable on a ratio scale, when the structure of value is currently not available for verification. Furthermore, since it has been pointed out above that an interval scale implies an equality of intervals between successive elements in a set, it is also incorrect to imply the existence of equal intervals on an unknown scale of value measurement in both assets and liabilities. Willet (1987) points out that in the accounting discipline there is no agreement linking the amount of monetary units paid to acquire a commodity and its value. Thus, it can be concluded that it is not possible to imply the equality of intervals of an unknown variable.

4.7 The application of the concept of the ratio scale in accounting

The concept of the ratio scale has its foundations in the concept of the existence of four relations in an operation, namely, equality, order rank, equality of intervals, and equality of ratios (Stevens, 1951). The ratio scale is a combination of the nominal, interval and the ordinal scale, together with the equality of ratios. Consequently, it also follows that the ratio scale will exhibit the properties of the nominal, interval and the ordinal scales. Stevens (1951), also points out that all types of statistical operations are applicable to the ratio scales. It is clear then that the ratio scale is quantitative in the ordinary sense of the word.

The use of the concept of the ratio scale is expressed fully in the accounting discipline. This is particularly notable in the use of financial ratios as indicators of performance. For example, referring to the quotation in section 4.6, Wolk *et al.* (2001:9) explain the use of the ratio scale in accounting as follows:

> Using the ratio type scale of measurement in accounting is at least possible because the zero point implies nothingness in terms of dollar amounts. Thus, in accounting, both $100,000 of current assets divided by $50,000 of current liabilities and $200,000 of current assets divided by $100,000 of current liabilities indicate twice as much current assets as current liabilities. This is possible only because of the uniqueness of the zero point in accounting.

The excerpt highlights the fact that a ratio scale is created when accounting information is analyzed through the use of ratios. The extract also points out that a ratio scale is created when the monetary amounts that represent the value of current assets is divided by the monetary amounts that represent the value of current liabilities to produce a current ratio. This division implies that the relationship between the amount of monetary units assigned to represent the value of an asset and the asset's value is identical to the relationship between the amounts of monetary units assigned to indicate the value of a liability and the

value of a liability. But, Ryan *et al.* (2002) note that there is no agreement relating the amount of monetary units assigned to represent the value of a commodity and the value of a commodity. Thus the relationship between the amount of monetary units assigned to represent the value of a commodity and the value of a commodity is ambiguous, and this relationship cannot be precisely specified. Indeed, it is clear that the relationship between current assets and current liabilities that is assumed in the creation of the current ratio cannot be empirically tested. It can therefore be concluded that the equality of ratios between current assets and current liabilities cannot be empirically tested.

Phenomena that cannot be precisely defined are not measurable. Stevens (1951) asserts that measurement is possible because there is a kind of isomorphism between the empirical relations among objects and events and the numerical structures that represent them. Since the relationship between the value of an asset or a liability and the amount of monetary units used to represent it is not specified, the existence of such isomorphism cannot be verified.

The measurement of intervals of monetary units is a ratio scale, but this does not mean that the monetary amount as a measure of the value of an asset or a liability is also a ratio scale. This is because value is subjective and as a result it is currently unknown whether value is measurable on a ratio scale. The ratio character of monetary unit measurement is based on the numerical representation of monetary intervals so that the value associated with the concatenation of adjacent intervals is the sum of values associated with those intervals. That is to say, monetary units can be represented on a number line. Furthermore, the concatenation of adjacent intervals of monetary units has, as far as is known, nothing empirically to do with the value of an asset or liability. Ryan *et al.* (2002) point out that monetary units have a standard scalar but there is no agreement relating them to a concept of value. If there is no reason to incorporate the monetary units into an empirical structure of the value of an asset or a liability, then there is nothing empirical about the representation of the value of an asset or

a liability that limits which monotonic transformations of monetary units can be used as indices of value.

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 measurements result from an underlying theory of measurement. It has already been pointed out in this study that accounting researchers have not succeeded in developing a theory of accounting measurement from the observation of accounting measurement practices. This suggests that the belief that value can be represented numerically is pre-theoretic.

There is an extensive theory for monetary unit measurements leading to ratio scale representations, indicating that monetary units can be represented by natural numbers. No comparable structure exists for the measurement of the values of assets or liabilities. A ratio scale exists for monetary units, but there is no independent theory for the measurement of the value of an asset or a liability, other than the pre-theoretic conjecture that the value of an asset or a liability is a monotonic function of monetary units. Moreover, there is no empirical relation between the notion of the value of an asset or a liability and the concatenations that pertain to the measurement of monetary units.

It should also be pointed out that the division of current assets by current liabilities does not lead to a ratio scale, as the relationship between current assets and current liabilities is not specified. Narens (2002) believes that it is necessary to specify the mathematical relations between objects before the assignment of numbers takes place. In this case, what is related between assets and liabilities is not known, as it is not specified in the accounting literature. Moreover, McLean, (2006) considers value to be a subjective concept. It is evident from this that it is not possible to know the exact relationship between the amount of monetary units paid to acquire a commodity and its value. Therefore, current ratios as well as other accounting ratios are not based on the ratio scale. From this discussion it

can thus be concluded that the concept of a ratio scale is misapplied in the discipline of accounting.

4.8- Summary and Conclusions

In chapter 1 it was noted that accounting is currently considered to be a measurement discipline. The principles of representational measurement have indicated that every measurement discipline is required to specify a scale of measurement. This belief has created the premise that scales of measurement exist in accounting. This chapter investigated the existence of scales of measurement in numerical assignments in accounting. It was noted that these numerical assignments do not meet the criteria of a true scale of measurement. This has also suggested that the dimensions and qualities of the entities that are currently being measured in accounting are not being measured on well-founded scales. This casts doubt on the truth of the belief that accounting is a measurement discipline.

A recapture of some of the main issues discussed indicates that:

- A scale is a rule of measurement that specifies the relationship between an empirical relational structure and a numerical relational structure. For example, the use of a metre rule in the measurement of height. In abstract algebra a scale is referred to as a homomorphism.
- A nominal scale is a simple classification system. It is at the bottom of the hierarchy of scales. It has properties that reflect only the identity of the phenomena it is measuring. It is used in the accounting discipline to classify the elements of financial statements.
- An ordinal scale is a scale that reflects the rank or order of the elements in a set. It discriminates between the elements in a set according to how much of the property an element in a set possesses. In the hierarchy of scales, it is higher-ranking than the nominal scale. It possesses the properties both of a nominal scale and of order.

- An interval scale reflects the equality of intervals between successive elements in a set. It is a higher-ranking scale than the nominal and the ordinal scales. It possesses the properties of a nominal scale, ordinal scale and the equality of intervals. This scale reflects the intrinsic properties of the object it is measuring.
- A ratio scale is a scale of measurement that reflects the equality of ratios among the elements in a set. It is a higher-ranking scale than the nominal, ordinal and the interval scales. It possesses the properties of the nominal, ordinal, and interval scales and the equality of ratios. This scale reflects the intrinsic properties of the object it is measuring.

It was noted that none of the principles of the scales mentioned above were properly applied during the construction of numerical assignments in accounting. Therefore, if accounting is to be considered a measurement discipline, the numerical assignments in accounting must be compatible with the concept of a scale in representational measurement.