

**Applying the representational theory of measurement
to accounting**

by

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Abstract

For many years, accounting discourse has been concerned with the measurement of attributes of accounting events. The concept of measurement forms one of the central pillars on which the preparation of financial statements is based. For example, financial statements can only be prepared if economic events meet the definition of an element of the financial statements and have a cost or value that can be measured with reliability. This has created the belief that accounting practices are practices of measurement.

The principles of measurement require that every process of measurement be based on an appropriate theory of measurement. Given the belief in the accounting discipline that accounting practices are synonymous with practices of measurement, it is to be assumed that acceptable theories of measurement exist in the discipline. However, over the decades, researchers in this field have been unsuccessful in creating an acceptable theory of accounting measurement. This suggests that there is a gap between the accounting concept of measurement and the scientific principles of measurement.

The main goals of this thesis are to determine whether the concept of measurement in accounting is in harmony with the principles of the representational theory of measurement and to develop a conceptual model of the accounting measurement problem. Representational theory establishes measurement in the social sciences. Accounting is regarded as a social science. This study applies the principles of the representational theory of measurement to determine the nature of the gap between the accounting concept of measurement and the principles of this theory.

The very fact of referring to accounting as a measurement discipline implies the presence of an established and well-known theory of measurement in that discipline: a discipline cannot be referred to as a measurement discipline without the existence of such a theory. Therefore, the lack of success of researchers in creating a theory of accounting measurement suggests that accounting is not a measurement discipline and that accountants are currently unaware of this.

To test this hypothesis:

1. A critical literature analysis was conducted, investigating whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement. The results of this analysis indicated that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement.
2. A questionnaire was sent to accountants, testing whether they were familiar with the principles of the representational theory of measurement and their application to the accounting discipline. The results of the survey indicated that accountants are not familiar with the principles of the representational theory of measurement or their application to the accounting discipline.

The main contributions of this study lie in the fact that it reveals that current accounting practices are not in harmony with the principles of representational measurement. Accountants should be educated in the purpose of the principles of measurement in the social sciences in order to ensure their proper application during accounting measurement.

Key Words

Representational Measurement, Homomorphism, Meaningfulness, Uniqueness, Existence Theorems

TABLE OF CONTENTS

CHAPTER 1:

Background and the research problem

1.1	Introduction	1
1.2	Literature review	5
1.3	Problem statement	8
1.4	Motivation	12
1.5	Beneficiaries of this research	14
1.6	Hypothesis	16
1.7	Purpose of the study	18
1.8	Research Methodology	18
1.8.1	Research methods and techniques	18
1.8.2	Literature survey	19
1.8.3	The identification of the principles of measurement	22
1.8.3.1	The application of the principles of measurement	23
1.8.4	Empirical study	24
1.8.5	The systems view of problem solving	24
1.9	Chapter layout	24

CHAPTER 2:

Research methodology- The principles of the representational theory of measurement

2.	Introduction	28
2.2	Research Methods	30
2.2.1	Analysis of the trends in current and previous research into accounting measurement.....	30
2.2.2	Normative research	35
2.2.3	Perspectives of research methodology	36



2.2.4	Research Strategy	37
2.2.5	Exploratory research	37
2.2.6	Literature survey	38
2.2.7	Empirical research	40
2.2.8	The Mitroff Model	40
2.3	The definition of measurement	45
2.3.1	Sources of the principles of representational measurement	48
2.4	The historical background of the representational theory of measurement	49
2.4.1	The underlying principles of representational measurement...	50
2.4.1.1	Background to the representational theory of measurement..	50
2.4.1.2	The formal principles of the representational theory of measurement	52
2.5	The application of the representational theory of measurement	60
2.6	Weaknesses of the representational theory of measurement	63
2.7	Summary and Conclusions.....	64

Chapter 3:

Representational measurement and the goals of accounting

3.1	Introduction	67
3.2	The role of measurement in the preparation of the financial statements	69
3.3	Accounting implications of measurement	70
3.4	Representational measurement and the objectives of financial statements	73
3.5	Summary and Conclusions	87

CHAPTER 4:

The concept of a scale in accounting measurement

4.1	Introduction	90
-----	--------------------	----



4.2	The concept of a representational scale	92
4.3	The significance of the concept of a representational scale in accounting	96
4.4	The application of the concept of the nominal scale in accounting	101
4.5	The application of the concept of the ordinal scale in accounting	103
4.6	The application of the concept of the interval scale in accounting	108
4.7	The application of the concept of the ratio scale in accounting	110
4.8	Summary and Conclusions	113

CHAPTER 5:

Representational measurement and the going concern assumption

5.1	Introduction	115
5.2	The going concern postulate and representational measurement	117
5.3	Representational measurement and the flowing accounting events	120
5.4	Measurement and the problem of futurity in accounting	123
5.5	The concept of time in accounting	126
5.6	Representational measurement and the accounting entity	129
5.7	The foundations of representational measurement under the going concern assumption	132
5.8	Summary and Conclusions	137



CHAPTER 6:

Measuring the values of accounting phenomena: An empirical challenge

6.1	Introduction	139
6.2	Applying the representational theory of measurement to the concept of value: The ambiguous nature of value	141
6.3	The credibility of monetary units as measures of value	145
6.4	Measurements versus indicants	147
6.5	The bases of accounting measurement	149
6.5.1	Elements, attributes and the bases of accounting measurement	149
6.5.2	The historical cost basis of accounting measurement	151
6.5.3	The current cost basis of accounting measurement	155
6.5.4	The net realizable value basis of accounting measurement	157
6.5.5	The present value basis of accounting measurement	157
6.5.6	The fair value basis of accounting measurement	159
6.6	The elements of the financial statements	160
6.6.1	The dimensions and qualities of assets	161
6.6.2	The dimensions and qualities of liabilities	163
6.6.3	The dimensions and qualities of income	164
6.6.4	The dimensions and qualities of an expense	166
6.6.5	The dimensions and qualities of equity	168
6.7	Summary and Conclusions	169

CHAPTER 7:

Objectivity and the accounting concept of measurement

7.1	Introduction	172
7.2	The role of perception in the concept of measurement in accounting	173
7.3	The objectivity of cost and value in accounting	176



7.4	The objectivity of the qualitative structures of accounting phenomena	179
7.5	The concept of measurement in accounting and the concept of public objectivity	182
7.6	The accounting concept of measurement and the concept of empirical objectivity	187
7.7	The accounting concept of measurement and the concept of formal objectivity	189
7.8	Summary and Conclusions	192

CHAPTER 8:

Representational measurement and the concept of relativism in accounting

8.1	Introduction	194
8.2	Framing and representational measurement in accounting	195
8.3	The concept of relativism in accounting measurement	197
8.4	Sources of relativism in accounting	201
8.4.1	Representational measurement and cognitive relativism in accounting	201
8.4.2	Representational measurement and cultural relativism in accounting	203
8.4.3	Representational measurement and the concept of linguistic relativism in accounting	206
8.4.4	Representational measurement and the concept of contractual relativism in accounting	208
8.5	Conclusions	211

CHAPTER 9:

Representational measurement and the presentation of accounting information the financial statements

9.1	Introduction	213
9.2	The compatibility of the balance sheet with representational Measurement	214
9.3	The compatibility of the income statement with representational measurement	219
9.4	The compatibility of the statement of changes in equity with representational Measurement	221
9.5	The compatibility of the cash flow statement with representational measurement	222
9.6	Representational measurement and the concept of time in the income statement and balance sheet	224
9.7	Representational measurement and the concept of classification in the financial statements	227
9.8	Representational measurement and performance measurement .	230
9.8.1	Representational measurement and earnings per share	230
9.8.2	Representational measurement and the concept of economic value added	233
9.8.3	Representational measurement and ratio analysis	235
9.9	Conclusion	237

CHAPTER 10:

The meaningfulness of accounting information

10.1	Introduction	239
10.2	The concept of representational meaningfulness	241
10.2.1	Meaningfulness and nominal scales	245
10.2.2	Meaningfulness and the ordinal scale	246



10.2.3	Meaningfulness and the interval scale	248
10.2.4	Meaningfulness and ratio scales	250
10.2.5	Meaningfulness and permissible statistics	251
10.3	Meaningfulness and the accounting conceptual framework	255
10.4	Meaningfulness and statutory requirements	257
10.5	Meaningfulness and the accounting concept of a scale	259
10.6	Meaningfulness and the going concern concept	263
10.7	Meaningfulness and the objectivity of accounting phenomena	264
10.8	Meaningfulness and the presentation of information in the financial statements	266
10.9	Meaningfulness and the logic of hypothesis testing	268
10.10	Summary and conclusions	269

CHAPTER 11:

Empirical research design, methods and techniques

11.1	Introduction.	272
11.2	Research Design	273
11.2.1	Control of variables.....	273
11.3	Research methods and techniques	274
11.3.1	Setting up the questionnaire	274
11.3.2	Pilot testing	283
11.3.3	Preparing a mailing list	283
11.3.4	Target population	283
11.3.5	Sampling frame	284
11.3.6	Sampling technique	285
11.3.7	Compiling a database	285
11.3.8	Distribution of questionnaires	286
11.3.9	Receiving the responses	286
11.4	Recording the responses	287
11.4.1	Follow up	287



11.5 Conclusion	287
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CHAPTER 12:

Research results-questionnaires for accountants

12.1 Introduction	289
12.2 Results of the questionnaire	290
12.2.1 Responses from the questionnaire	291
12.3 Conclusion	343

CHAPTER 13:

Towards a model of accounting measurement

13.1 Introduction	346
13.2 The reality problem situation in accounting measurement and the development of its conceptual model	347
13.2.1 Phase 1 of the Mitroff's 4-phase problem solving model.....	347
13.2.2 Phase 2 of the Mitroff's 4-phase problem solving model.....	351
13.2.2.1 The concept of representational measurement	351
13.2.2.2 Measurements versus indicants in accounting	356
13.2.2.3 Measurement and accounting reality	359
13.2.2.4 Measurement and simulated reality in accounting.....	360
13.2.2.5 The accounting conceptual framework as a basis of accounting measurement	362
13.3 Creating indicants and measurements in the accounting discipline	363
13.4 Conclusion	367

CHAPTER 14:

Conclusion and suggestions for future research

14.1	Introduction.	368
14.2	Conclusions	369
14.2.1	Conclusions from a theoretical perspective	369
14.2.2	Conclusions from the empirical perspective	373
14.2.2.1	Measurement in the accounting conceptual framework context	373
14.2.2.2	Measurement and the nature of accounting phenomena under the accounting conceptual framework	374
14.2.2.3	Measurement and the recognition of accounting phenomena	375
14.2.2.4	The integrity of accounting information created under the accounting conceptual framework	375
14.2.2.5	Measurement and the concept of time under the accounting conceptual framework	376
14.2.2.6	The principles of representational measurement	376
14.3	Limitations of the study	377
14.3.1	Limitations in terms of the theoretical component.....	377
14.3.2	Limitations in terms of the empirical component	378
14.4	Contributions to research	379
14.5	Further research	381
14.5.1	Important research topics	382

LIST OF FIGURES

Figure. 2.1	A systems view of problem solving	41
Figure 5.1	Accounting's arrow of time	127
Figure10.1	Stevens' scales of measurement against the concept of meaningfulness	254
Figure 13.20	Explanation of the symbols used in flow charts	

design	353
Figure 13.21 Flow chart depicting the process of representational measurement	354
Figure 13.3 Measurements versus indicants	358
Figure 13.4 Steps to creating measurements and indicants	365

LIST OF TABLES

Table 2.3: Previous and current research	32
Table 12.1: Statement 1:	293
Table 12.2: Statement 2:	295
Table 12.3: Statement 3:	296
Table 12.4: Statement 4:	297
Table 12.5: Statement 5:	298
Table 12.6: Statement 6:	302
Table 12.7: Statement 7:	304
Table 12.8: Statement 8:	305
Table 12.9: Statement 9:	306
Table 12.10: Statement 10:	307
Table 12.11: Statement 11:	311
Table 12.12: Statement 12:	312
Table 12.13: Statement 13:.....	313
Table 12.14: Statement 14:	314
Table 12.15: Statement 15:	315
Table 12.16: Statement 16:	317
Table 12.17: Statement 17:	318
Table 12.18: Statement 18:	319
Table 12.19: Statement 19:	320
Table 12.20: Statement 20:	321
Table 13.21: Statement 21:	322
Table 12.22: Statement 22:	323
Table 12.23: Statement 23:	326



Table 12.24: Statement 24:	327
Table 12.25: Statement 25:	328
Table 12.26: Statement 26:	329
Table 12.27: Statement 27:	330
Table 12.28: Statement 28:	331
Table 12.29: Statement 29:	333
Table 12.30: Statement 30:	335
Table 12.31: Statement 31:	336
Table 12.32: Statement 32:	337
Table 12.33: Statement 33:	338
Table 12.34: Statement 34:	339
Table 12.35: Statement 35:	340
Table 12.36: Statement 36:	341
Table 12.37: Statement 37:	342

REFERENCES

References	384
------------------	-----

APPENDICES

Appendix A	410
Appendix B	415

LIST OF DEFINITIONS

Axiom- A true statement about a qualitative structure or an empirical relational structure

Homomorphism- A mapping between two algebraic structures in such a way that the result obtained by applying the operations to the elements of the first set is mapped onto the result obtained by applying the corresponding operations to their respective images in the second

Indicant – These are effects or correlates related to psychological dimensions by unknown laws

Meaningful measure- A measure is meaningful if it is clear what statements may be made about it that preserve its true meaning.

Numerosity of monetary units – The quantity of monetary units assigned to represent the cost or value of a commodity or of an item that meets the definition of an element of the financial statements

Representational measurement theory - A theory which comprises many related theories of measurement that require a scale to be a set of structure preserving mappings (e.g., a set of isomorphisms or homomorphisms) from some qualitative or empirically based structure into a structure from pure mathematics

Chapter1-Background and the research problem

“Measurement is one of our most ordinary actions. We speak its language whenever we exchange precise information (Alder, 2004:2)”

1.1 Introduction

The concept of measurement is pervasive to everyday life. The history of measurement and mathematics shows that man has practiced measurement for thousands of years but only in recent ages has anyone analyzed the meaning of what he did (Abdel-Magid, 1979:346). It was the need for reliable information about man’s environment that gave rise to the concept of measurement. Information that is reliable reduces the uncertainty about the physical world in everyday decision making.

In this study, it is important to note that some of the references used are over seven decades old. This is because research in accounting measurement has been very limited. During the literature analysis carried out in this study, it was established that research on accounting measurement conducted over sixty years ago (e.g., see, Gillman, 1939; Paton and Littleton, 1940) is still relevant to this day. Furthermore, the last major attempt to create a theory of accounting measurement was made by Ijiri (1975). Since then, there have been no major attempts to formulate a theory. The concept of accounting measurement that was relevant over sixty years ago is still relevant today.

Moreover, the references to theories of measurement used in this study consist mainly of research work that was carried out over eighteen years ago (see, Luce, 1996). Since the creation of the modern measurement theory by Scott and Suppes in 1958, and the establishment of the three volumes of the *The Foundations of Measurement* by Luce, Krantz, Suppes and Tversky (1971, 1989, 1990), there have to date been no new perspectives on the principles of

measurement. For this reason these old reference are considered to be relevant to this study.

Measurement is a mathematical concept. According to Stevens (1951:1), the concept of measurement is useful to the extent that the attributes of the objects being studied can be represented by mathematical principles. This suggests that measurement conveys information about the physical world that would not be available without the use of mathematical principles. It can be inferred that measurement is applicable to phenomena that possess characteristics that can be represented with the principles of mathematics. This requires that the properties of the phenomenon being measured are identical to the mathematical properties used to represent it. For example, the height of a man expressed in centimetres should be equivalent to his non-metrical height.

According to Ackoff (1962:195), there is no general agreement among scientists and philosophers on what measurement is and how it should be performed. This has given rise to different views of measurement in the natural and social sciences. Currently, there are two theories of measurement: classical and modern (Michell, 1995). The classical theory views measurement as the assignment of numerals to represent empirical properties of physical phenomena (Michell, 1995:245). Under this concept, numbers are intrinsic to the situations to which they are applied. The numbers are the empirical properties of the physical phenomena that are being described. The classical theory of measurement is applicable to the natural sciences (Mattessich, 1964). This indicates that in the natural sciences the properties of empirical phenomena are identical to the numbers used to represent them. From this it follows that, in the natural sciences, the properties of empirical phenomena can be inferred from the numbers used to represent them.

The modern measurement theory is also known as the representational theory of measurement (Luce *et al*, 1971, 1989, 1990). Scott and Suppes (1958) developed this theory, as the classical theory of measurement was not applicable to the

social sciences. The classical theory of measurement was not applicable to the social sciences due to the fact that it takes the empirical view of the number. Under this theory a number is supposed to represent the empirical properties of the phenomenon it is representing. However, in social sciences numbers do not always represent the empirical properties of the phenomenon they are representing. Sometimes they are used as a form of physical identification. The representational theory of measurement covers measurements in both the social and the natural sciences. According to Narens (2002) the representational theory comprises many related theories of measurement. He argues that what they have in common is that they require a scale to be a set of structure preserving mappings (e.g., a set of isomorphisms or homomorphisms) from some qualitative or empirically based structure into a structure from pure mathematics. Homomorphic or isomorphic transformations do not always result in the representation of the empirical properties of the algebraic structure being transformed to another algebraic structure. It is therefore evident from this that under the representational theory, numerical assignments that do not result in the representation of the empirical properties of the object that is being measured by the numerals assigned are also considered to be measurements. For this reason, the representational theory of measurement is also applicable to social sciences.

The concept of measurement is currently employed in the accounting discipline (see, IASB, 2006; Wolk, Tearney and Dodd, 2001). It is evident from this that a particular theory of measurement will be used in accounting depending on whether accounting is a physical or a social science. Accounting is classified as a social science (Ryan, Scapens and Theobald, 2002:9). Consequently, the theory that is applicable to this discipline is the representational theory of measurement. An analysis of the accounting literature indicates that the concept of measurement forms an important part of accounting terminology. Definitions and accounting practice also suggest that accounting is a measurement discipline (e.g. AICPA, 1941; Bierman, 1963; IASB, 2006; Wolk *et al*, 2001). For this reason, accounting

practice ought to comply with the principles of the representational theory of measurement.

Representational measurement literature (Luce *et al*, 1990:323) asserts that every process of measurement must have an underlying theory of measurement. Consequently, it would be expected that the accounting discipline would have an underlying theory of measurement. However, attempts to formulate a theory of accounting measurement have failed and there is consensus on this point (e.g. Gilman, 1939; Goldberg, 2001; Ijiri, 1975, 1967; Littleton, 1953; Staubus, 1985). The reasons attempts to formulate a theory of measurement failed in accounting are many. They range from outright misunderstanding of the theory of measurement, to the inability of accountants to distinguish what is measurable from what is not in accounting. Some of these failures are elaborated upon in section 1.2 below. This lack of success suggests that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement.

Given the contradictory views in the discipline on whether or not accounting is a measurement discipline, it is necessary to investigate whether the accounting concept of measurement reflects the principles of a true measurement discipline. The purpose of this chapter is to outline the background of the research study and the research problem. The chapter also briefly outlines the methodology used in this study.

Following the introduction, a brief literature review is conducted in section 1.2, followed by the statement of the research problem in section 1.3. A motivation for researching the problem is presented in section 1.4. The importance of the proposed work and the possible beneficiaries of the outcome of this research are discussed in section 1.5. The hypothesis is presented in section 1.6, while the research aims and objectives are outlined in section 1.7. In section 1.8, a brief outline of the research methodology followed in this work is presented. The chapter layout of this study is presented in section 1.9.

1.2 Literature review

The application of measurement theory to accounting is not a new idea. Vickrey (1970), noticing the lack of a measurement theory in accounting, questioned the status of accounting as a measurement discipline. He applied the realist's theory of measurement to evaluate whether accounting was in fact a measurement discipline. The realist's theory of measurement advocates that measurements should reflect the empirical properties of the object they are representing (Michell, 1995). This means that measurements should reflect the intrinsic properties of the object being measured. Vickrey (1970) came to the conclusion that accounting is not a measurement discipline and that there is no property that is currently measured in accounting apart from the numerosity of monetary units. This suggests that there is no theory of measurement in the accounting discipline apart from a theory that describes the measurement of monetary units.

Vickrey (1970) also points out that the nominal scale is not a scale of measurement, and that the existence of an extensive property is necessary in order for accounting to be a measurement discipline. A nominal scale is a scale that reflects only the identity of the object that it is measuring. It does not reflect the empirical properties of this object (see chapter 4). Vickrey's assertion indicates that he used the realist's theory of measurement to evaluate whether accounting was a measurement discipline. The realist's perspective of measurement takes the empirical view of a number (Michell, 1995:245). Numbers are supposed to represent the empirical properties of the phenomena that they represent. But the nominal scale does not have properties that are beyond identity and difference (Stevens, 1951:25). This suggests that the nominal scale does not reflect the intrinsic properties of the phenomenon being measured, and implies further that that a nominal scale cannot be a scale of measurement under the realist's perspective of measurement.

The difficulty with Vickrey's (1970) study is that in his attempt to evaluate whether accounting is a measurement discipline he applied the principles of the realist's

theory of measurement. According to Luce *et al.* (1971), the realist's theory is suitable to the natural sciences. Accounting is a social science (Tinker, 1985) and so a theory of measurement that is appropriate to social sciences should be used. Mattessich (1964) also points out that accounting measurements cannot be inferred through natural laws, but through the intuition of the experimenter. It is evident from this that accounting measurements are dependent on the judgments of the accountant. It follows, then, that accounting measurement should be viewed relative to the environment of the accountant. Furthermore, even though this view is old, it is still applicable today in accounting (see Ryan *et al.*, 2002). Consequently, it can be argued that the theory of measurement that should be used to evaluate whether accounting is a measurement discipline should always involve a conventional component, that is, the agreement to code certain empirical attributes with certain numbers, and certain empirical relations with certain numerical ones. Thus, the principles of the representational theory of measurement (Decoene *et al.*, 1995) that equate measurement to numerical coding should have been used by Vickrey (1970), instead of the realist's theory of measurement, in order to establish whether accounting is a measurement discipline.

Furthermore, Vickrey's (1970:738) belief that an extensive property is necessary for accounting to be a measurement discipline is beset with problems. Accounting is a social science. Luce *et al.* (1971) point out that there are problems in the application of extensive measurement to social sciences. This is because of the inadequate interpretation of the concatenation operation in the measurement of non-physical attributes. However, Luce *et al.* (1971) also indicate that some attributes of the social sciences can be measured extensively; and subjective probability is an outstanding example. But it would be unfair to apply a theory of measurement that only applies to a minority of attributes in a discipline. Such a theory would not make accounting a measurement discipline.

The IASB framework (2006) for financial reporting points out that the attribute of accounting phenomena that is subject to measurement is value. This suggests

that for accounting to be a measurement discipline, there must be a theory of value measurement. Abdel-Magid (1979) asserts that the property subject to measurement in an exchange transaction is exchange value, which is measured by the monetary numerosity at the time of exchange. He also argues that accounting is a social science and, as a result, measurement that is used in social science should be applied in accounting. It can be inferred from this that in the accounting discipline monetary units represent the properties of the values of accounting phenomena. This suggests that the assignments of monetary units to the values of accounting phenomena in exchange transactions are expected to be processes of measurement.

However, Abdel-Magid's (1979) argument does not take into account that, for the measurement of value to occur, a prerequisite (Luce *et al.*, 1971:13) of representational measurement is that a qualitative structure of value should be specified. Currently, the concept of value is considered to be an ambiguous one that is not an intrinsic property of an accounting entity (McLean, 2006). This means that there is no agreement among accountants on the empirical properties of value. It follows that, currently, value cannot be empirically tested in the accounting discipline. 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 suggests that the phenomenon that is subject to measurement must be empirically testable. It can also be inferred that measurement is applicable only to objective phenomena. Therefore, it can be concluded that value is not currently measurable in accounting.

Other notable attempts to develop a theory of accounting measurement are those by Ijiri (1965, 1975) and Mattessich (1964). None of Ijiri's (1965, 1975) attempts at developing such a theory are in harmony with the principles of the representational theory of measurement. For example, the value allocation rule of measurement (Ijiri, 1965) reveals the author's lack of understanding of the principles of measurement. The value allocation rule suggests that the adding of

values allocated to outgoing resources produces a meaningful value for the decrease in resources resulting from an exchange. Yet, the addition operation in accounting is not given a qualitative interpretation so that the resulting total has an empirical interpretation. According to Luce *et al.* (1971), the application of extensive measurement to non-physical attributes of objects needs an adequate interpretation for the concatenation operation. In the absence of an adequate interpretation of this operation, measurements that are not similar could be added to each other.

Moreover, Ijiri's study (1975) demonstrates a lack of understanding of the principles of representational measurement. According to Ijiri (1975), measurement is not concerned with a single object, but rather with a relation among objects. This viewpoint demonstrates an inadequate understanding of the concept of measurement. Firstly, the concept of measurement assigns numbers to attributes of objects and not the objects themselves. Therefore, it is possible for measurement to be concerned with the attributes of a single object. Secondly, relations can also be found among the attributes of the same object and not only among attributes of different objects. Another crucial point that discredits Ijiri's (1975) attempts to develop a theory of accounting measurement is his inability to distinguish between measure theory and measurement theory. Orbach (1978) points out that part of the reason for Ijiri's (1975) failure to examine the qualitative basis of accounting measurement lies in the fact that he uses measure theoretic concepts instead of measurement theoretic concepts. Measure theory does not require the specification of the attribute to be measured, while measurement theory does. In Ijiri's (1975) study there are no specified attributes that are the subject of measurement. This indicates that Ijiri (1975) used measure theory in his attempt to create a theory of accounting measurement.

1.3 Problem statement

In section 1.1 it was pointed out that accounting is currently believed to be a social scientific measurement discipline. This has led to the premise that accounting practices reflect the properties of a true measurement discipline in the social

science category. Various authors (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Staubus, 1985; Vickrey 1970) have over time voiced consensus that the accounting discipline has not succeeded in creating a theory of accounting measurement from the observation of accounting practices of value measurement. According to Ryan *et al.* (2002:118), every process of measurement must have a theory of measurement. Consequently, this suggests that the accounting concept of measurement does not reflect the properties of a true measurement discipline in its category. This leads to confusion as to whether or not accounting is a measurement discipline.

According to the IASB framework (2006, Para 83) for financial reporting, an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured with reliability. It can be inferred from this viewpoint that the objects of measurement in the preparation of financial statements are cost or value. Consequently, theories of measurement that should exist in the accounting discipline are those of value measurement and cost measurement. Therefore, it can be deduced that theories of measurement that are lacking in the accounting discipline are those of cost measurement and value measurement. It can also be deduced that there are no foundations of value measurement and cost measurement.

Tinker (1985:78) highlights the fact that the theory of value used in accounting does not adequately describe all the value assignments given to the elements of financial statements. He argues that this inadequacy is caused by the fact that the accounting discipline focuses on the marginalism theory of value, neglecting other competing theories. The marginalism theory of value advocates that the value of a commodity is determined by its price (Tinker, 1985). This view indicates that the accounting discipline does not have a comprehensive theory of value. It can thus be inferred that accountants do not have a precise definition of value in accounting. It can be further inferred that the focus of the accounting discipline on the marginalism theory of value indicates that accountants do not have a broad perspective of the drivers of value in accounting. That is to say, accountants are

not aware of the potential contributions that other competing theories of value can bring to accounting. Consequently, the accounting discipline cannot adequately describe perspectives of value that are not covered by the marginalism theory of value.

The marginalist theory of value holds that the price paid to acquire a commodity represents the value of that commodity (Debreu, 1959). In this case, he argues that the value of the commodity is reflected by the utility that the buyer expects to derive from its consumption. Authors such as Dobb (1937) and Tinker (1985), note that utility is both ambiguous and subjective. This suggests that value of utility cannot be empirically verified. It follows that there may be numerous prices that can be used to represent the same amount of utility. Furthermore, there might be more than one theory for measuring the value of a commodity.

Accounting research also indicates that there is confusion in the accounting discipline with regard to the identity of the central ideas of accounting measurement practices. Staubus (2004, 1985), and Chambers (1997) note that there are no standardised accounting measurement practices. They argue that the choice of an accounting practice is dependent on its convenience to the user. This leads to the incompatibility of accounting practices of measurement across different frames of reference. Staubus (1985:53) describes the situation as follows:

If a scientist far removed from accounting asked an accountant to tell him the central ideas of accounting measurement practices, what could the accountant say? Could he say that historical cost is the basis of accounting measurement? Surely he could not feel that he has conveyed the essence of the subject by reference to a principle that applies to a minority of balance sheet items?

This extract indicates that there are numerous practices of accounting measurement that are not coherent. It is also clear that none of the practices of accounting measurement can give rise to a theory that explains in totality the

accounting concept of measurement. Since every process of measurement must have an underlying theory, it is questionable whether these accounting practices are measurement practices after all. Staubus (1985:53) supports this when he states:

To my knowledge, no one has woven accounting measurement practices into a coherent, comprehensive theory.

These words indicate that there is a great deal of literature on accounting measurement, but none of this has managed to provide an appropriate outline of a theory of accounting measurement. The sentence also alludes to the lack of success of the accounting discipline in trying to weave accounting measurement practices into a comprehensive and coherent theory of accounting measurement. It should be noted that every measurement practice must have an underlying theory (Ryan *et al.*, 2002). If different accounting measurement practices cannot be integrated into a comprehensive and coherent theory, it could mean that these practices follow different underlying theories of measurement. It could also mean that different accounting measurement practices are measurement practices for different attributes. It would then follow that such practices are based on different theories of measurement.

Chambers (1997) makes the point that there are no foundations of accounting measurement. In particular, he notes that there are no specified scales of measurement or attributes that are of use and interest to measurement, or specified units in the scales of measurement. Since the IASB (2006, Para 83) identifies cost and value as the objects of measurement in accounting, it could be inferred that the properties of cost and value that are measurable are not specified or identifiable in the accounting literature. But, the principles of representational measurement require the specification of scales of measurement, attributes that are of use and interest to measure and units in the scales of measurement (Luce *et al.*, 1971:12). The question that must be asked, therefore, is how measurement can take place in accounting in the absence of specified foundations of

measurement. In order to answer this question, it is necessary to investigate whether the current concept of measurement in accounting is in harmony with the principles of the representational theory of measurement.

1.4 Motivation

The motivation for this study is to add to the body of knowledge on accounting measurement. The problem addressed in this thesis concerns the lack of a theory of accounting measurement. It has been noted in section 1.3 that there is consensus in the accounting discipline that accounting researchers (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Staubus, 1985; Vickrey, 1970) have not succeeded in creating a theory of accounting measurement. This lack of success implies that accounting might not be a measurement discipline as previously believed. It is thus essential to find the reason accounting is referred to as a measurement discipline in the absence of a theory of accounting measurement. Furthermore, it would initiate an evolutionary process that would help create foundations of accounting measurement, and thus make accounting a true measurement discipline. If this was achieved, it would make information in financial statements more reliable and objective. This is because all measurement information must be empirically verifiable and must not change its meaning irrespective of the frame of reference (see, Luce *et al*, 1971; Stevens, 1951). It would therefore, enable the users of this information to make more credible economic decisions, given that the information they are using is empirically verifiable.

Financial statements are prepared on the premise that accounting is a measurement discipline. According to the IASB (2006, Para 83), an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured with reliability. This implies that the information contained in financial statements is measurement information. This also suggests that it is not possible to prepare financial statements in the absence of principles of measurement.

The IASB framework (2006) for financial reporting is currently a statement of interrelated objectives and theoretical principles, providing reference for the underlying accounting discipline. It establishes the basis for determining which events should be reported, how they should be measured and the format in which they should be communicated to users (see, Hemus *et al*, 2000). This creates the impression that the information contained in financial statements has characteristics that are consistent with the principles of measurement. However, as noted above, accounting research has not succeeded in creating a theory of accounting measurement from the observation of accounting measurement practices. This casts doubt on the assertion that accounting is a measurement discipline. If accounting is not a measurement discipline, incorrect inferences might be drawn from the information in financial statements, on the premise that accounting information is measurement information. Such incorrect inferences would affect the economic decisions made by users. If users were aware of whether or not the concept of measurement in accounting is in harmony with the principles of measurement, it would assist them in drawing inferences from and understanding the true nature of accounting information.

According to Mautz and Sharaf (1961:15), auditing is concerned with verification, the examination of financial data for the purpose of judging the faithfulness with which they portray events and conditions. These authors also argue that verification requires the application of techniques and methods of proof. This suggests that the existence of the audit function rests on the premise that information can be empirically verified. It can also be inferred that the employment of techniques and methods of proof during the auditing of accounting information can only provide evidence of representational faithfulness if the accounting information is objective. It follows that the audit function verifies whether the information in financial statements is objective. According to Decoene *et al.*, (1995:238) measurement is applicable to objectively existing entities. This suggests that all measurable phenomena are objectively determinable entities. Establishing whether or not accounting is a measurement discipline thus also

provides evidence of whether or not accounting information can be empirically verified and whether this information is reliable.

1.5 Beneficiaries of this research

The following users of financial statements could benefit from this research:

- *The accounting profession:* As far as the author is aware, there is no prescribed theory of accounting measurement in general use. Therefore, knowledge of whether the accounting concept of measurement is in harmony with the principles of measurement would help identify the exact cause of the measurement problem in accounting. If current accounting practices are in harmony with the principles of measurement, it would imply that efforts should be concentrated on developing a theory of accounting measurement from current accounting practice. But if this is not the case, it would imply that efforts should be concentrated on developing accounting practices that are in harmony with the principles of measurement, ones from which a theory of accounting measurement can be developed. Furthermore, such knowledge helps to determine whether accounting is appropriately classified as a measurement discipline, or whether a new classification is required.
- *Chartered accountants in practice:* Chartered accountants in practice are arguably the largest group of people who possess the highest accounting professional qualification who deal with the measurement issues in the preparation of the financial statements. Currently, accounting is considered to be a measurement discipline (Vorster *et al*, 2008; IASB, 2006; Wolk *et al*, 2001). This suggests that accountants believe that they are providing accounting measurement information in their financial statements. Therefore, knowledge of whether or not the accounting concept of measurement is in harmony with the principles of measurement informs practising accountants of the true measurement position of current accounting practice. Such knowledge would identify any need to modify

- current accounting practices to make them compatible with the principles of measurement, to reclassify accounting practices as something other than practices of measurement, or to leave them as they are. Accounting measurement is dependent on the intuition of the accountant (Mattessich, 1964:79). This means that accounting measurements are dependent on the opinion of the accountant. Consequently, new information on accounting measurement would also raise awareness among accountants about the need for accounting practices to comply with the principles of measurement if accounting is to be considered a measurement discipline.
- *The auditing profession:* This research also benefits auditors. According to Soltani (2007:4), auditing is the process of providing assurance about the reliability of the information contained in financial statements. This means that the purpose of auditing is to verify whether accounting information is objective. Information is objective if it can be empirically verified: it may be verified if there is a standard against which it can be compared. This means that auditors need some standard against which to compare accounting information. Accounting is currently considered to be a measurement discipline (IASB, 2006; Wolk *et al.*, 2001). It is evident, then, that accounting information is compatible with the principles of measurement. All processes of measurement must have a standard against which they can be compared (Ryan *et al.*, 2002). It is clear from this that it is to be expected that there are standards against which accounting measurements can be compared. However, currently there are no standards for such comparisons (Chambers, 1997). It seems that the auditing profession cannot provide adequate assurance about the objectivity of the financial statements from the measurement perspective to users of the financial statements. Therefore, knowledge of whether or not the accounting concept of measurement is in harmony with the principles of measurement would inform practising auditors of the true measurement position of current accounting practice. They would thus be able to reassure users from a measurement perspective.

- *All users of financial statements:* Currently, accounting literature (Chambers, 1997; Ryan *et al.*, 2002; Willet, 1987) points out that the foundations of accounting measurement are not clearly stated in the accounting literature. This research proposes a way forward in the establishment of the foundations of accounting measurement. Such foundations would provide a standard against which accounting measurements could be compared. The establishment of such standards would enhance the reliability of accounting information provided to users.

1.6 Hypothesis

It has been noted earlier (e.g., AICPA, 1941; Bierman, 1963; IASB, 2006; Kirk, 2005) that current accounting literature contends that accounting is a measurement discipline. It follows, then, that the concept of accounting measurement would exhibit the properties of a true measurement discipline in its category.

On the other hand, there is also consensus (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Staubus, 2004, 1985), from the observation of accounting measurement practices that the discipline of accounting has not succeeded in creating a theory of accounting measurement. Yet, every process of measurement must have a theory of measurement (Ryan *et al.*, 2002). This suggests that the accounting concept of measurement is not in harmony with the principles that establish measurement in social sciences. If the lack of success of the accounting discipline in creating a theory of accounting measurement suggests that the concept is not in harmony with representational measurement principles, the question to be answered is why accountants continue to refer to accounting as a measurement discipline. It could be that they are not familiar with the principles of measurement and, as a result, believe that whatever numerical assignments they make, they are measuring. It should also be pointed out that financial reporting is regulated by statute. In South Africa, for example, the format and content of company financial statements is prescribed by the Companies Act

of 1973, more specifically by the Fourth Schedule thereof, and statements of Generally Accepted Accounting Practice that are published by the South African Institute of Chartered Accountants (Benade, Hennings, Du Plessis, Delpont, De Koker and Pretorius, 2006:205). It is thus clear that accountants are forced by statute to follow certain numerical assignments that are prescribed by the South African Institute of Chartered Accountants, even though they do not regard these assignments as measurements. Consequently, it may be that the reason accountants refer to accounting as a measurement discipline is because of statutory requirements, otherwise they would not be referring to accounting as a measurement discipline.

It should be pointed out, however, that accounting research that has aimed to create a theory of accounting measurement from the observation of accounting practices (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Staubus, 2004, 1985) has spanned over six decades. This suggests a firm belief that there is some form of measurement taking place in accounting practice. It also indicates that if this is not the case, accountants are not yet aware of this. If they were, they would not be trying to create a theory of accounting measurement from the observation of accounting practice itself.

The discussion in this section points out that accounting is currently considered to be a measurement discipline that does not have a theory of measurement, despite the fact that every measurement process should be underpinned by such a theory. This assertion is certainly contrary to the principles of measurement.

Therefore the hypothesis of this study is that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement, and accountants are not aware of this.

1.7 Purpose of the study

In order to address the research problem in an organized and systematic manner, the following research objectives have been formulated:

- To determine whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement
- To determine whether accounting is a measurement discipline as suggested by the accounting literature
- To investigate whether chartered accountants are aware that accounting is a measurement discipline or not
- To propose new areas of future research to address the problem of accounting measurement
- To develop a conceptual model of the problem of accounting measurement
- To propose a scientific model of the problem of accounting measurement
- To propose a scientific model of a solution to the accounting measurement problem

1.8 Research methodology

1.8.1 Research methods and techniques

According to Cooper and Schindler (2003), a research methodology consists of a set of methods for acquiring, defining, classifying and verifying knowledge. Four research methods were used in this study:

1. *Literature survey*: A critical analysis of the literature was conducted. The results of this critical literature analysis are reported throughout the thesis. The purpose of such an analysis is discussed in chapter 2.
2. *The identification of the principles of measurement from literature*: The principles of the representational theory of measurement were identified from the literature survey as the principles that establish measurement in the social sciences. As accounting is a social science, it was decided that these principles should be used to establish whether or not the accounting

- concept of measurement is in harmony with the principles of measurement (see chapter 2).
3. *The application of representational theory of measurement to accounting:* The representational theory of measurement was also compared to the accounting concept of measurement. The results are reported throughout this thesis.
 4. *Empirical research:* A questionnaire was sent out to chartered accountants. The development of the questionnaire is outlined in chapter 11. The results of the questionnaire are reported in chapter 12.
 5. *The systems view of problem solving:* The model for problem solving that was designed by Mitroff, Betz, Pondy and Sagasti (1974:48) was used in this study to analyse, among other things, the problem of establishing whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement (see chapter 13).

1.8.2. Literature survey

In conducting this research a critical analysis of relevant literature was conducted. This literature survey spanned several disciplines, including accounting, management accounting, finance, mathematics, physical sciences, strategic management, philosophy and psychology. The role of the literature survey in each discipline is explained below as follows:

- **Accounting**-The survey of the accounting literature helps the researcher to understand the accounting environment in which the principles of measurement are applied. It also helps to understand the current measurement beliefs in accounting. According to Stevens (1951:1), measurement is a preoccupation of psychophysics. This means that all measurements must be evaluated in relation to the environment in which they have been created. It is thus necessary to understand the accounting environment first, before the evaluation of accounting measurements. The accounting literature (IASB, 2006) points out that the objects of

measurement in accounting are cost and value. It is therefore necessary to understand cost and value before it can be established whether these two are measurable.

- **Management Accounting-** According to Ijiri (1975: ix), accounting is also considered to be a system for providing information that is useful for making economic decisions. Since management accounting deals with the provision of information for making economic decisions, a survey of the literature on management accounting must be conducted.
- **Finance-** The survey of finance literature informs the study on the concept of value. This concept is one of the subjects of measurement in accounting. According to Caws (1959:3), measurement presupposes something to be measured, and, unless we know what that something is, no measurement can have any significance. This means that it is necessary to fully understand the concept of value before evaluating measurements of value. As the concept of value has its applications in finance, to understand this concept and its uses, one needs to study finance literature.
- **Mathematics-**The concept of measurement is a mathematical concept (Stevens, 1951). This means that the principles of measurement lie in mathematics. In order to understand the concept of measurement it is necessary to survey the mathematical literature on measurement. Luce *et al.* (1971) recommend that in order to understand the principles of representational measurement, mathematical material on sets, relations, functions, probability, topology, abstract algebra and calculus must be thoroughly grasped. This study was undertaken after a thorough review of the relevant literature. In section 1.3 it was noted that the accounting discipline has not managed to create an acceptable theory of accounting measurement. Ryan *et al.* (2002) point out that every process of measurement must have an underlying theory of measurement. This

indicates that the principles of mathematics are not being employed adequately in accounting.

- **Physical Sciences**-The concept of measurement originated as classical measurement that occurs in the physical sciences. The representational theory of measurement that is discussed in this study is applicable to both the physical and the social sciences, and the source of classical measurement is in the physical sciences. Consequently, a survey of the physical science literature on classical measurement must be conducted in order to fully understand the representational theory of measurement.
- **Strategic Management**-Strategic management utilizes information for decision-making. The concept of pragmatics in measurement refers to how measurement information is used (Stevens, 1951). In measurement theory (Stevens, 1951) the meaningfulness of measurement information is also dependent on its uses. Accounting research has indicated that there are limitations in accounting information as far as usefulness is concerned. These limitations have been elaborated upon extensively in the financial literature (see Evans 2003; Francis and Schipper 1999; Lev and Zarowin, 1999; Sterling 1997). This suggests that the measurement concept of meaningfulness is not being employed adequately in accounting. It is thus necessary to study strategic management in order to understand the pragmatic meaningfulness of measured accounting information.
- **Psychology**-The concept of representational measurement was initially developed for psychologists (Stevens, 1946; 1951). Mathematical psychologists (Luce *et al.*, 1971; Scott and Suppes, 1958) modelled the principles of representational measurement on the measurement of psychological phenomena. It follows that in order to fully understand the application of principles of representational measurement to social sciences, then it is necessary to study the applications of the theory to psychology. In addition, accounting measurements are also dependent on the intuition of accountants (Mattessich, 1964). Accounting measurements are thus influenced by the psychological state of the accountant.

Consequently, mathematical psychology literature on representational measurement must also be studied.

- **Philosophy-** The philosophy discipline is fundamental to accounting practice. According to Flanders (1961), accounting studies derive their basic meaning from learning philosophy. In order to understand the accounting concept of measurement it is therefore necessary to study the philosophy of this concept of measurement.
- **Quantum Physics-** According to Goldberg (2001), accounting activities are assumed to flow into a business. It can be argued that accounting activities possess both momentum and position. Bohmn (1980) remarks that the laws of quantum mechanics indicate that it is impossible to measure both position and momentum: one measures one or the other. The laws of quantum physics are based on the observation of reality. Consequently, if accounting phenomena are believed to be in motion, one may argue that since accounting events are real, in order to understand the concept of flow in accounting, one must understand the principles of quantum physics.

1.8.3.The identification of the principles of measurement

In section 1.1 it was noted that accounting is a social science. This means that in order to determine whether the accounting concept of measurement reflects the characteristics of a true measurement discipline one must compare the characteristics of this concept with the characteristics of a theory of measurement that establishes measurement in social scientific disciplines such as accounting. The principles of the representational theory of measurement are used to achieve this purpose. This theory of measurement was designed to establish measurement in both the social sciences and the natural sciences (Luce *et al.*, 1971; Luce, *et al.*, 1990; Luce *et al.*, 1989). These three volumes outline the principles of representational measurement comprehensively. Luce *et al.* (1990:323) recommend that in order to determine whether a particular variable is measurable, a detailed empirical and theoretical analysis of the relevant

phenomena must be made. They assert that during the process of analyzing the phenomena, the theory of measurement can help clarify the status of different numerical assignments. Consequently, the opinion in this study is that the application of the representational theory of measurement to the qualitative structures of accounting phenomena should reveal whether or not different numerical assignments in accounting are in harmony with the principles of representational measurement.

1.8.3.1 The application of the principles of measurement

The application of the principles of measurement to accounting is not a new idea. For over four decades, accounting researchers (e.g., Chambers, 1960, 1997; Ijiri 1965; Orbach, 1978; Staubus, 1967; Vickrey, 1970; Vollmer, 2007; Willet, 1987, 1988) have applied the principles of measurement to accounting in a bid to formulate the foundations of accounting measurement. However, these studies applied mainly the principles of classical measurement that occur in the physical sciences. None of the previous studies used the principles of the representational theory of measurement to establish whether the accounting concept of measurement reflects the characteristics of a true measurement discipline. This is because the application of these principles to social science is a relatively new area that is still under development (see Luce, 1996) and these studies were not aware of this theory. The present study applies the principles of representational measurement to determine whether or not accounting is a true measurement discipline. Orbach (1978:13) regards the application of the principles of measurement to accounting concepts as theoretical research. Vickrey (1970) holds the same view. For this reason this researcher considers the application of these principles to accounting concepts of measurement made in this study to be theoretical research.

1.8.4 Empirical study

In order to test whether or not members of the South African Institute of Chartered Accountants are aware that accounting is not a measurement discipline, an empirical study was conducted. For this purpose, a questionnaire was compiled following a thorough and critical analysis of the literature (see chapter 11). The aim of the questionnaire was to investigate whether chartered accountants in South Africa are familiar with the application of the concept of representational measurement to accounting. The questionnaire was sent to chartered accountants who are members of the South African Institute of Chartered Accountants. The results of the questionnaire are presented in chapter 12.

1.8.5. The systems view of problem solving

The aim of this study is, among other things, to determine whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement. The model for problem solving designed by Mitroff *et al* (1974:48) was used to better understand the measurement problem in accounting. This model involves a systemic view of problem solving. According to Mitroff *et al.* (1974), a systematic approach to problem solving includes conceptualization, modelling, model solving and implementation. This study uses the Mitroff model to help conceptualize, identify and solve the measurement problem in accounting. The model is discussed fully in chapter 2.

1.9. Chapter layout

Chapter 2 Research Methodology - The principles of the representational theory of measurement

This chapter outlines part of the research methodology that is used in this study. The other part (questionnaire survey) of the research methodology is outlined in chapter 11. The principles of the representational theory of measurement are outlined and discussed in this chapter. These principles will be compared to the

accounting concept of measurement in order to determine whether this concept is in harmony with the principles of the representational theory of measurement.

Chapter 3 Representational measurement and the goals of accounting

In chapter 3 the author discusses whether the goals of financial reporting are in harmony with the principles of the representational theory of measurement. The concept of measurement presupposes the achievement of a goal. Measurement theory points out that this goal must be achieved to be in harmony with the principles of measurement, and for measurement to have any significance.

Chapter 4 The concept of a scale in accounting measurement

This chapter introduces the concept of the scale to the study. This concept is fundamental to all measurement disciplines. A discussion that evaluates whether the concept of a scale is properly applied to the accounting discipline is included.

Chapter 5 Representational measurement under the going concern assumption

All measurements occur at a particular point in time regardless of what has happened before or what will happen afterwards. Yet the accounting concept of measurement asserts that the magnitudes of accounting measurements under the going concern concept are dependent on subsequent events. This chapter questions the possibility of having representational measurements whose magnitudes are dependent on future events.

Chapter 6 Measuring the values of accounting phenomena: an empirical challenge

Chapter 6 comprises a discussion of whether value is measurable under the representational theory of measurement. It also questions whether the amount of monetary units paid to acquire a commodity is a measure of the value of a commodity.

Chapter 7 Objectivity and the accounting concept of measurement

All measurements are intended to be objective. This means that accounting measurements are also expected to be objective. The focus in this chapter is on evaluating whether accounting practices can be considered objective under the representational theory of measurement.

Chapter 8 Representational measurement and the concept of relativism in accounting

This chapter focuses on the relative nature of accounting practices of measurement. In particular, the chapter discusses the framing activities of these practices and the effects of the various sources of relativism on the accounting concept of measurement, namely the effects of cognitive, cultural, linguistic and contractual relativism.

Chapter 9 Representational measurement and the presentation of financial statements

The theme in this chapter is whether financial statements are presented in a way that is in harmony with the principles of the representational theory of measurement. The focus includes whether the accounting concept of performance measurement is in harmony with the principles of representational measurement.

Chapter 10 The meaningfulness of accounting information

The concept of meaningfulness is fundamental to all measurement information. This chapter analyzes whether accounting information can be considered meaningful.

Chapter 11 Empirical research design, methods and techniques

The role of this chapter is to report on the research design, methods and techniques used in the empirical study, which includes the use and analysis of a questionnaire. The application of the principles of the representational theory of measurement to accounting is also discussed. The role of the empirical research is also discussed in this chapter.

Chapter 12 Research results

In this chapter the author reports on the results of the literature review and of the questionnaire.

Chapter 13 Towards a model of accounting measurement

This chapter presents the main contributions of this thesis, namely, the identification of the variables that underlie the measurement problem in accounting, and the identification of characteristics that make accounting a measurement discipline.

Chapter 14 Conclusions and future work

In this chapter a summary of the previous chapters is provided and directions for future work in this area are discussed. The remainder of the dissertation comprises various appendices and a bibliography.

Chapter 2-Research Methodology - The principles of the representational theory of measurement

2.1 Introduction

Measurement theory and the representational theory of measurement have a critical role to play in the social sciences. The need for measurement in the social sciences and the considerable difficulty in applying the principles of fundamental measurement gave rise to the creation of the representational theory of measurement, a theory that establishes measurement in the social sciences. In chapter 1 it was established that accounting is considered to be a measurement discipline. It was also noted that accounting principles are considered to be social scientific principles. This suggests that the principles of measurement that are applicable to accounting are the principles of the representational theory of measurement.

Chapter 1 highlighted the fact that, from observing accounting practices of measurement, accounting researchers have not succeeded in creating a theory of accounting measurement. Luce *et al.* (1971) point out that every process of measurement must have an underlying theory of measurement. This has given rise to the belief in this study that the accounting concept of measurement might not be in harmony with the principles of the representational theory of measurement that has established measurement in the social sciences.

The principles of the representational theory of measurement are used in this study to identify the nature of the measurement problem in accounting. These principles, which are referred to as the principles of modern measurement theory, are comprehensively outlined in the three volumes of the “Foundations of Measurement” (Vol. 1, 2 and 3) by Luce, Krantz, Suppes and Tversky (1971, 1989, 1990). According to Luce and Narens (1994), the representational theory of measurement began largely as a way of understanding the source of physical measurement. The history of this can be traced as far back as Helmholtz (1887)

and Holder (1901). But as time has moved on, the representational theory of measurement has greatly generalized the understanding of the scope of measurement possibilities and has provided increasingly useful applications to the behavioural and social sciences (Luce, 1996:95). It is these applications to the social sciences that are of fundamental importance to this study. Luce *et al.* (1990) recommend that the principles of the representational theory of measurement be used to establish whether or not a particular numerical assignment is a process of measurement. This recommendation is employed in this study to establish whether the numerical assignments in accounting are processes of measurement.

It was noted in chapter 1 that the accounting concept of measurement lacks a theory of measurement and a precise specification of the foundations of measurement. The theory and foundations of measurement form the backbone of a measurement discipline. It is therefore necessary to establish whether the accounting concept of measurement has the qualities of a true measurement discipline in accordance with established measurement principles. The purpose of this chapter is to discuss part of the research methodology used in this study to establish this. A discussion of the empirical research is also provided in chapter 11.

This chapter commences with a discussion of the research methods in section 2.2 and its subsections. The definition of measurement is discussed in section 2.3, followed by a discussion of the sources of representational measurement in section 2.3.1. A brief history of the representational theory of measurement is presented in section 2.4. The principles of representational measurement are outlined in section 2.4.1 and its subsections. A discussion of the application of this is provided in section 2.5, followed by a discussion of the weaknesses of the theory in section 2.6. The chapter is concluded in section 2.7.

2.2 Research Methods

2.2.1 Analysis of the trends in current and previous research into accounting measurement

It was mentioned earlier (see, chapter 1) that the application of the principles of measurement to accounting is not a new idea. There is a great deal of literature on the concept of measurement in accounting. The trends in this literature indicate that there has been very little development in accounting measurement methodology: history indicates that there have been considerable methodological disputes. Early researchers into accounting measurement, such as Gilman (1939), Littleton (1953) and Paton and Littleton (1940), believed that accounting practices were practices of measurement without a theory to back them up. The focus of these studies was on cataloguing accounting practices of measurement and attempting to find common points among them. However, these studies did not succeed in establishing either the common points or the phenomenon that was being measured. The view of these early studies mentioned above is one that is held by accountants even today. For example, Wolk *et al.* (2001) and the IASB framework (2006) for financial reporting still consider accounting to be a measurement discipline even in the absence of a theory of accounting measurement. This suggests that the perspectives of the accounting concept of measurement have not changed over the past sixty years.

In the 1960s authors such as Chambers (1960), Ijiri (1965), Ijiri and Jaedicke (1966), McDonald (1967) and Staubus (1967) realized that the accounting concept of measurement produced measurements that were not objective. These studies attempted to base the accounting concept of measurement on a system of axioms, but without success. However, these studies still considered accounting to be a measurement discipline even in the absence of specified foundations of measurement. Furthermore, they did not specify the theory of measurement on which the numerical assignments in the accounting discipline were based. Moreover, these studies failed to establish the cause of the lack of objectivity of accounting measurements. These studies neither catalogued the accounting

practices prevalent at the time nor did they attempt to establish a theory of accounting measurement from accounting practices. The attempt to formulate axioms on which to base accounting measurement suggests that these authors believed that there were no bases of measurement in accounting and as a result they needed to formulate these bases. This also indicates a change in the methodological perspective of accounting researchers. Current accounting literature (IASB, 2006; Staubus, 2004; Vollmer, 2007; Wolk *et al.*, 2001) have also failed to specify the foundations of accounting measurement. This further underlines the reality that the problems that the accounting discipline attempted to solve over forty years ago have yet to be explained.

Vickrey (1970) questioned the status of accounting as a measurement discipline. He applied the principles of fundamental measurement that are encountered in the natural sciences to evaluate whether accounting is a measurement discipline. He argued that for accounting to be a measurement discipline, it is necessary to find an extensive accounting property. Since all extensive measurements are additive (Luce *et al.*, 1971) this indicates that all accounting measurements must be additive. This viewpoint suggests that measurement can only occur in accounting once an extensive accounting property has been found. However, accounting is a social science, and the principles of measurement that are applicable to natural sciences are not applicable to social sciences. Luce *et al.* (1971) pointed out that the existence of an extensive property is not a prerequisite for measurement to occur in the social sciences. There are some structures such as conjoint and difference measurement in which non-extensive measurement occurs. To date, no research has been conducted in accounting to establish whether or not accounting measurements are extensive measurements. However, accounting literature (e.g. IASB, 2006; Kirk, 2005; Vollmer, 2007; Wolk *et al.*, 2001) recommends that accounting measurements should be added to financial statements. It is clear then, that an extensive property is still being considered as fundamental to accounting measurement. Almost forty years on, this view has not changed.

Ijiri (1975) attempted to develop an axiomatic theory of accounting measurement. He developed this “theory” without specifying either what attribute was being measured or a scale of measurement. This was the last major attempt by an accounting researcher to create a theory of accounting measurement. An analysis of Ijiri’s work reveals that he confused measure theory with measurement theory. Measure theory does not require the specification of the attribute that has to be measured, while measurement theory does. In this case, Ijiri developed a measure theory of accounting and not an accounting measurement theory. Authors also such as Staubus (1985), Chambers (1997), Walker and Jones (2003) and Staubus (2004) also noted that there are no specified attributes that can be measured in accounting. Vollmer (2006, 2007) and McLean (2006) also highlight the current lack of foundations in accounting measurement. This analysis shows that from 1939 to date there has been no progress in the development of the foundations of accounting measurement. The problems that existed then in accounting are those that exist now. Successive research has not built on past studies. These researchers all show a conflicting understanding of accounting measurement. It is thus clear that there is currently no methodological rationale that can be justified in integrating accounting research on measurement. For this reason, the focus of this study is on conducting a foundational analysis of accounting measurement by comparing the principles of accounting measurement to those of the representational theory of measurement. Table 2.3 summarizes previous and current research in accounting measurement.

Table 2.3 Previous and current research in accounting measurement

Year	Researcher	Nature of the accounting measurement research
1939	Gilman	Discussed the concept of measurement in relation to the prevailing accounting practices. He made attempts to establish a theory of accounting measurement from prevailing accounting practices. He did not attempt to give a precise definition of the objects that are subject to measurement in accounting. These objects have been identified as cost and value by the accounting literature.
1940	Paton & Littleton	They attempted to produce a theory of accounting measurement from the observation of accounting practices of measurement. This study did not



		attempt to give a precise definition of the properties being measured. Furthermore, their study did not attempt to define value or cost, or to give an empirical identity to cost or value.
1953	Littleton	He attempted to induce a theory of accounting measurement from the observation of accounting practices, but he did not identify the attributes that were being measured by the practices he was observing. It is not clear from his study whether it was cost or value that was being measured.
1960	Chambers	He discussed the view that accounting measurement does not necessarily lead to the presentation of relevant information in financial statements. The gap in his study is that he does not define precisely what is being measured in accounting. The study does not discuss whether or not the measurement of cost or value provides relevant information to financial statements.
1965	Ijiri	He made attempts to develop an axiomatic theory of accounting measurement. His axiomatic theory was not based on the properties of cost or value. Whether or not the axioms created in this study represent the true properties of cost or value cannot be verified.
1966	Ijiri & Jaedicke	They discussed the reliability and objectivity of accounting measurements. The study argued that accounting measurements are not reliable or objective. The study does not highlight whether the measurement of cost or value leads to subjective measurements.
1967	Staubus	He discussed current cash equivalent as a possible measure of the value of an asset. Discussed the credibility of asset measurement methods prevailing at the time.
1967	McDonald	He discussed the feasibility criteria for accounting measures. He focused on what is measurable in accounting and what is not. He failed to establish what is measurable in accounting apart from monetary units or whether cost and value are measurable.
1970	Vickrey	He questioned the status of accounting as a measurement discipline. He concluded that there is no property that is currently measured in accounting apart from the numerosity of monetary units. This study indicated that at that particular point in time it was not possible to determine whether cost and value are measurable.
1975	Ijiri	He made attempts to develop a theory of accounting measurement. However, he used the principles of measure theory instead of measurement theory. The study failed therefore to specify a theory of accounting measurement.
1985	Staubus	He made attempts to induce a theory of accounting measurement from the observation of accounting practices of measurement.
1985	Tinker	He discussed the various theories of value (e.g. Marginalist, Canonist value theory, mercantilist value theory). The study concluded that value is an ambiguous concept that is not empirically testable. He also concluded that accountants do not have a precise definition of cost or value. That is, there are no foundations for measuring cost or value.



1997	Chambers	He revealed that there are no foundations of accounting measurement.
2003	Walker & Jones	They discussed a possible way forward in accounting measurement. They considered possible attributes of accounting phenomena that are measurable. However, cost or value was not established as one of the measurable attributes in accounting.
2004	Staubus	He discussed the prevailing views of accounting measurement. He attempted to establish the central ideas of accounting measurement. His attempts focused on finding the attributes of accounting phenomena that are measurable but he failed to establish this.
2006	Vollmer	He discussed the meaning of financial numbers to users. He concluded that their meaning is relative to the user. The concept of meaning depends on what the user wants to draw from the numbers. The study suggests that the meaning of cost or value measurement is relative to what the user wants to infer from the measurement.
2006	McLean	He proposed new concepts of measuring value. However, the research does not provide a precise definition of value. The study does not mention whether or not cost is measurable.
2007	Vollmer	He investigated various ways in which numbers are involved in the ordering of activity in social situations. He concluded that accounting numbers are relative to a specific frame of reference. The study therefore suggests that the measurement of cost or value in accounting is relative to social situations.

2.2.2 Normative research

The representational theory of measurement describes and sets the standards or rules that measurement in the social sciences should follow. The rules of measurement set by this theory validate whether a particular numerical assignment in social science can be described as a measurement. Luce *et al.* (1990:325) recommend that the principles of the representational theory of measurement should be used in deciding whether a particular numerical assignment to a phenomenon in social sciences is a process of measurement. They point out that for the representational theory of measurement to be used in the process of validating a numerical assignment, a detailed empirical and theoretical analysis of the phenomenon that is being measured must first be conducted. During the process of analyzing the phenomenon, the theory of representational measurement can help clarify the status of the numerical assignment and whether it is a measurement or not. These recommendations are discussed below as follows:

- A detailed empirical and theoretical analysis of the phenomenon that is being measured must be conducted. This ensures that the object of measurement is appropriately understood prior to measurement. This gives clarity as to the exact identity of the property of the object that is being measured (see section 2.4.1.2).
- During the process of analyzing the phenomenon, the theory of representational measurement can help clarify whether the numerical assignment is a measurement or not. This procedure helps to clarify whether the methods employed in measurement are compatible with the characteristics of a true measurement discipline.

This highlights the fact that the representational theory of measurement creates the norm or the code of behaviour that numerical assignments in the social sciences could follow if they are to be considered measurements. In this study, the principles of the representational theory of measurement are used to establish

whether the numerical assignments in accounting can be considered measurements. For this reason, this research methodology is considered normative. The reality problem identified as a result of the application of the representational theory of measurement is analyzed by means of the Mitroff model. The Mitroff model is discussed in section 2.2.8 below and the results of the normative research are analyzed in chapter 13.

2.2.3 Perspectives of research methodology

There are three distinguishable levels of the methodological dimension of research, namely methodological paradigms, research methods and research techniques. According to Mouton (1998) methodological paradigms are the most abstract level and they include the distinction between qualitative and quantitative techniques. Research methods are those that are used at certain stages of the research process, for example sampling, data collection and data analysis. Research techniques represent the most concrete level of the methodological dimension and include specific techniques related to sampling, data collection and data analysis.

Other terms related to research methodology are research strategy and research design. Research strategy guides the research effort by defining the context within which it will be conducted. It also provides the link between the research objectives and research activities. Research strategy is partly derived from the methodological paradigm – qualitative or quantitative – that fits a particular research problem. Research design, on the other hand, is defined as a plan of how a research project will be conducted, specifying who or what is involved, and where and when it will take place (Duplooy, 2001). In other words, research strategy indicates which direction will be taken, while research design indicates what needs to be done while heading in that specific direction.

In this study, the research strategy includes an exploratory research strategy, a critical literature analysis, empirical research and the Mitroff *et al.* (1974) model for

problem solving. The research design employed in this study discusses whether or not it is necessary to control the variables that affect accounting measurement. A full discussion of the research strategy is carried out in the sections that follow in this chapter and the research design used in the questionnaire survey is given in chapter 11.

2.2.4 Research Strategy

Recognized research methods are employed in this study, amongst others an analysis of existing data, namely, a literature survey and a questionnaire. A comprehensive literature analysis is undertaken and a questionnaire prepared from the statements formulated from the literature analysis is sent to members of the Institute of Chartered Accountants of South Africa. The principles of the representational theory of measurement that are used in this study are outlined in this chapter in the sections below.

2.2.5 Exploratory research

Exploratory research is conducted when there is very little other research on a specific topic (Welman and Kruger, 2005). In chapter 1 it was established that the accounting researchers (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Paton and Littleton, 1940; Sterling, 1966) have not succeeded in creating a theory of accounting measurement from the observation of accounting measurement practices. This suggests that accounting practices of measurement are pre-theoretical. It was also noted in chapter 1 that no previous study has applied the principles of the representational theory of measurement to accounting to determine whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement. No research has ever been conducted to establish whether accountants are aware of whether or not the accounting concept of measurement is in harmony with the principles of the representational theory of measurement. It was thus established that the principles of exploratory research are suitable for this study. Furthermore,

according to Cooper and Schindler (2003), the objectives of exploratory studies include collecting new data, developing hypotheses or questions for further research, clarifying concepts and establishing research priorities. This study collects new information about the application of the concept of representational measurement in accounting and it identifies new areas for further research in accounting measurement.

This study also aims to establish whether the reference to accounting as a measurement discipline (e.g. AICPA, 1941; Bierman, 1963; Wolk, *et al*, 2001) is appropriate. A natural result of this study is the identification of the shortcomings of the current approach in order to identify priorities for future research. In addition, the literature review has not managed to establish a study that used a questionnaire to test whether accountants are aware of whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement and their application. Therefore, it can be concluded that this study is exploratory.

2.2.6 Literature survey

A thorough literature review is crucial to the success of a research project. According to Ryan *et al.* (2002), the success of the whole research project depends on the quality of this step. In this study a thorough literature analysis is conducted. The importance of a literature review, as outlined by Ryan *et al.* (2002), is discussed below. The comments of Ryan *et al.* (2002) are italicised:

- *A thorough review of relevant literature, and a process of refinement of the issues posed by the research problem is a crucial stage and the success of the project depends on this step.* In this study a thorough literature review indicated that the concept of measurement lies outside the accounting discipline. It is a concept whose principles lie in mathematics. It follows that answers to the research problem (the establishment of whether or not the accounting concept of measurement is in harmony with the principles of measurement) also lie in mathematics.



- *Literature review ensures that previous studies are not duplicated.* It was noted in chapter 1 that the application of measurement theory to accounting is not a new idea. Authors such as Chambers, 1997, Willet 1988 and 1987, Ijiri, 1975, and Vickrey, 1970 have applied the principles of measurement to accounting. However, none of the previous studies have applied the principles of the representational theory of measurement to determine whether the accounting concept of measurement is compatible with the principles of the representational theory of measurement or whether accountants are aware of whether or not the principles of representational measurement are in harmony with the principles of representational measurement.
- *To find the most recent and authoritative literature on the subject area.* The most authoritative literature on the representational theory of measurement was found to be the three volumes on *The Foundations of Measurement* by Luce *et al.* (1971, 1989, 1990). The principles of representational measurement applied in this study are based on these three volumes.
- *To discover what the most widely accepted empirical findings in the field of study are.* In chapter 1 it was noted that there is no prior research that has tested whether accountants are aware of whether the accounting concept of measurement is compatible with the principles of the representational theory of measurement. No study was found to have tested whether accountants are familiar with the principles of representational measurement and their applications.
- *To ascertain the most widely accepted definitions of key concepts in the field.* In this study it was noted that before the development of the representational theory of measurement, the concept of measurement did not have a precise definition. It was necessary to conduct a thorough literature review to establish an appropriate definition of measurement. The literature review was also necessary to find an appropriate theory of measurement applicable to the accounting discipline.

In order to conduct a thorough literature analysis one needs access to books, conference proceedings, journal articles (national and international), theses and dissertations. To find the relevant articles, searches were carried out using the electronic library of the University of Pretoria.

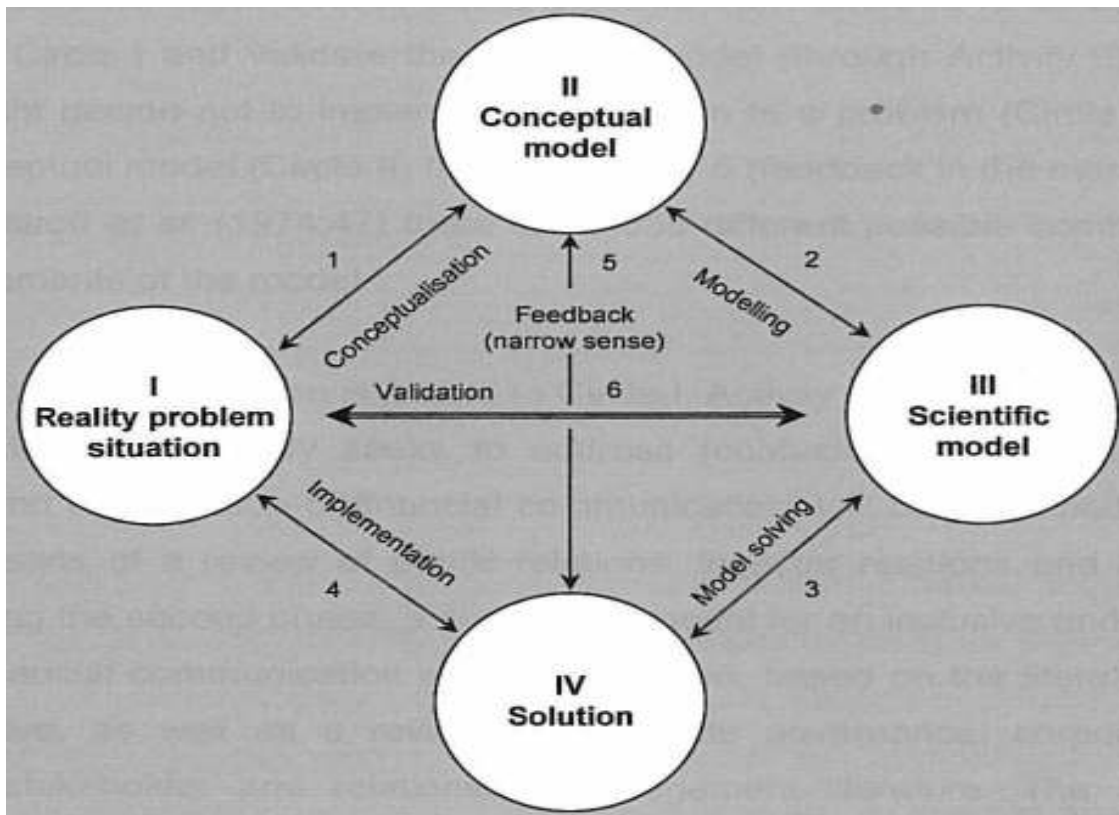
2.2.7 Empirical research

In order to investigate whether or not accountants are aware that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement, a questionnaire was developed in MS Word 2000 format. This questionnaire was aimed at members of the South African Institute of Chartered Accountants. Most questionnaires were sent by e-mail but some were hand delivered. The purpose of the study was set out on the cover page and the questionnaire followed on page 3. The sequence of events that was used to prepare, send and analyze the responses to the questionnaires is outlined in chapter 11.

2.2.8 The Mitroff Model

In chapter 1 the Mitroff model (1974) was introduced to help explain the scope of this study. The scope of this thesis may be explained more specifically in terms of the model for problem solving designed by Mitroff, Betz, Pandey and Sagasti (1974). Koornhof (1998) used the Mitroff *et al.* (1974) model in an accounting thesis on the concept of “flexibility” and found it useful in providing legitimacy to an exploratory and non-formal research topic. The model is depicted in figure 2.1 below.

Figure 2.1 A systems view of problem solving



Source: Mitroff *et al.* (1974:48)

The model takes a holistic or systems view of different varieties of scientific activities. It has no definite beginning or ending. In terms of this model, research is seen as continuous. A research project could begin at any of the circles 1, 2, 3 or 4. That is, in relation to this study, the determination of whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement could begin at any point of the model. For example, a research project may start at Circle 1, with the identification of a problem situation. Since it was noted in chapter 1 section 1.3 that the problem in this study is the absence of a theory of accounting measurement, this suggests that this study could begin with activities that are aimed at discovering the reasons accounting researchers have not succeeded in creating a theory of accounting measurement. Activity 1 conceptualises the problem so as to develop a conceptual model in

Circle 2. In this study it would be necessary to conceptualise the measurement problem in accounting so as to develop a conceptual model of this measurement problem. According to Koornhof (2001), the conceptual model sets out in broad terms the definition of the particular problem that will be solved. It then specifies the field variables that will be used to define the nature of the problem and the level at which the variables will be treated. In this study this would entail the specification of the variables that affect the accounting concept of measurement. Currently, these variables are not known.

Activity 2 entails the formulation of the scientific model in Circle 3. According to Rivert (1972:9), a scientific model is a set of either qualitative or quantitative logical relationships which link together the relevant features of the reality with which we are concerned. This would require the specification of a scientific model of the measurement problem in accounting. It requires the identification of all the variables that affect accounting measurement and the relationships between them. A model of the variables that affect accounting measurement that is empirically testable would qualify as a specified scientific model.

The third phase would concern the performance of activity 3 to derive a solution from the scientific model while an implementation of activity 4 would entail feedback of the solution to the original problem situation. In validation activity 6 the degree of correspondence between reality and the scientific model may be evaluated. Finally, in activity 5, namely feedback in the narrow sense, problem-solving activities (Circles 2, 3, 4) are applied, with the goal being to derive better scientific solutions from the activities and elements in the model. Mitroff *et al* .(1974:53) remarks that a single research project rarely covers all the circles and activities. Various combinations of circles and activities can be used. In this study this would entail the derivation of a solution to the measurement problem in accounting. This would involve the creation of a theory of accounting measurement and the specification of the foundations of accounting measurement. The testing of the created theory of accounting measurement

would follow, and then the evaluation of the feedback on the validity of the theory of accounting measurement.

The research for this dissertation is limited to Circle 1, Activity 1, Circle 2 and partly Activity 2. In the first phase, the problem this study seeks to address is discussed.

The problem in this study is determining whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement and whether or not members of the South African Institute of Chartered Accountants are aware of whether or not the current accounting concept of measurement is in harmony with the principles of the representational theory of measurement. This is done by a review of the literature on accounting measurement and by comparing the current accounting practices with the principles of the representational theory of measurement. In order to establish whether members of the South African Institute of Chartered Accountants are aware of whether or not the current accounting concept of measurement is in harmony with the principles of the representational theory of measurement, a questionnaire is used. In phase 2 of the Mitroff *et al.* (1974) model a conceptual model of the real problem is developed. This defines the problem to be solved in broad terms and specifies any field variables that will be used to define the nature of the problem. In this thesis, this involves the identification of the perspectives surrounding the measurement problem in accounting. A discussion of the application of the Mitroff *et al.* (1974:53) model to problem solving in analysing the results of this study is provided in chapter 13.

In chapter 3 the reality of the problem situation is described by means of a review of the implications of the principles of the representational theory of measurement on the definition and the objectives of accounting. The chapter also discusses the current application of the principles of representational measurement to accounting. An analysis is also carried out in chapter 3 of the use of the principles of measurement in accounting with particular reference to whether the definition and objectives of accounting are in harmony with the principles of the

representational theory of measurement. The problem situation entails three interrelated shortcomings of the current application of the principles of representational measurement to accounting:

- The intuition that accounting phenomena can be represented numerically is pre-theoretical
- The chartered accountants are oblivious to the idea that physical indices of accounting phenomena are not measurements
- The lack of foundations for accounting measurement

In chapters 4, 5, 6, 7, 8, 9 and 10 a further description of the reality problem situation is given and a theoretical justification for the need to develop foundations for accounting measurement is provided. This is done by a review of whether current accounting practices are in harmony with the principles of the representational theory of measurement. In chapter 13, a conceptual model of the research problem and a proposition for a scientific model of the research problem is developed, based on the content of chapters 2,3,4,5,6,7,8,9,10 and 12.

Therefore, from the theoretical perspective, Circle 1, Circle 2 and part of Circle 3 of the Mitroff *et al.* (1974) model would have been covered. The purpose of the questionnaire survey is to supplement the theoretical component. The research design, methods and techniques for the questionnaire survey is discussed fully in chapter 11. Survey research is therefore used in this study:

- To find out whether members of the South African Institute of Chartered Accountants are aware of whether or not the accounting concept of measurement is in harmony with the principles of the representational theory of measurement.

Finding out whether accountants are aware of the current status of accounting as a measurement discipline helps in determining where the accounting measurement problem really lies. If chartered accountants are aware of whether or not accounting is a measurement discipline this would help determine whether or not chartered accountants have adequate measurement knowledge to prepare

financial statements. It would also help in re-evaluating the accounting education of chartered accountants. It might be necessary to introduce the principles of measurement into the accounting curriculum.

2.3 The definition of measurement

A review of the literature on measurement reveals that this concept has been blighted by a lack of a precise definition. For example, Campbell (1952) argues that for measurement to occur the measurement structure should be defined in such a way that it satisfies the axioms of additivity. This definition reflects that the properties of all measurable phenomena should be capable of representation by positive natural numbers. Luce *et al.* (1971) point out that all additive measurements are extensive measurements. It can be inferred from this that Campbell (1952) believes that all measurements must be extensive measurements. Stevens (1959:24) asserts that in order for some form of measurement to take place, all that is required is a consistent rule of assignment. It is clear from this that the random assignment of numbers to objects is excluded. It is also clear that measurement does not have to be additive. This also indicates that Stevens' (1959) view of measurement is broader than that of Campbell (1952). That is to say, since both additive and non-additive measurements are included in Stevens' (1959) point of view of measurement, his view includes more forms of measurement than that of Campbell (1952).

In the early definition of measurement given above by Campbell (1952), it is evident that the concept of the additivity of measurements was seen as fundamental to the definition of measurement. This requirement excluded measurements in the social sciences. Luce *et al.* (1971:123) point out that the lack of an adequate interpretation for the concatenation operation makes it difficult in most attempts to apply the theory of extensive measurement to non-physical attributes such as utility, intelligence or loudness. In particular, it is difficult to find an adequate interpretation for an additive operation in the social sciences. Accounting is a social science and consequently it lacks an adequate

interpretation of the concatenation operation that is found in the natural sciences. This has led to the development of other axiom systems as a basis for fundamental measurement in social science, such as difference measurement, conjoint measurement and expected utility measurement (Luce *et al.*, 1971:124). These axiom systems are not additive structures. This indicates that the requirement that all measurements should have a concatenation operation is not sufficient to cover all the aspects of the concept of measurement.

A move towards a more modern definition of measurement was made by Caws (1959:5). He defines measurement as “the assignment of particular mathematical characteristics to conceptual entities in such a way as to permit an unambiguous mathematical description of every situation involving the entity and the arrangement of all occurrences of it in a quasi-serial order”. This definition implies that there should be a precise knowledge of the relationship between the assigned numbers and the underlying empirical relational structure. It is not possible to measure a phenomenon of which one has no knowledge. Willet (1987) points out that in the accounting discipline the relationship between value and the monetary units assigned to represent it is not known. This suggests that value is currently not measurable in accounting. Caws (1959:3) adds, “measurement presupposes something to be measured, and, unless we know what that something is, no measurement can have any significance”. This reinforces the fact that a precise description of the qualitative structure is required before measurement takes place.

The modern definition of measurement appears to require that measurements be representative of the underlying phenomenon. Orbach (1978) points out that although the precise definition of measurement requires a mathematical formulation, measurement may be described as the process of identifying selected attributes of a set of objects (or events) and assigning numbers (or mathematical entities, such as vectors) to objects so that the properties of the attributes are “preserved” or “represented” by the assignment. In defining measurement this way, he points out that all measurements are representative of

the underlying phenomenon and are also unique. Similarly, Narens (2002:746) states, “ ... each meaningful set of measuring functions on a qualitative domain **A** has a characterization as a set of structure preserving mappings from a qualitative structure with domain **A** into a purely mathematical structure”.

This quotation points out that measurement only occurs if there is a representation of the empirical relational structure with a numerical relational structure in such a way that the properties of the empirical relational structure are preserved by the numerical relational structure. This concept of the representational theory of measurement reinforces the belief that all measurements must be representative of the properties of the structure they purport to be representing. This indicates that it should be possible to infer an empirical relational structure from the numerical relational structure that is representing it. Mundy (1986) also emphasises that all measurements should be representative of the properties of the phenomena they purport to be representing. It follows, then, that all that is necessary for measurement to occur is a true representation of the properties of an empirical phenomenon by a numerical relational structure. This is the theory of measurement that is discussed in this study.

The discussion above indicates that the lack of a precise definition has led to a poor understanding of the concept of measurement over the years. It can be argued that this poor understanding of the concept has been demonstrated in the accounting discipline (e.g. Chambers, 1997; Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Paton and Littleton, 1940; Staubus, 2004, 1985; Sterling, 1966) by the lack of success of accounting researchers over the years in establishing a theory of accounting measurement. Furthermore, it is currently still not known what the monetary units in financial statements represent (Ryan *et al.*, 2002:118). This means that the empirical relational structure that monetary units represent in accounting is unknown. This has created a representation problem in the concept of measurement in accounting.

2.3.1 Sources of the principles of the representational theory of measurement

This section identifies the main sources of the principles of the representational theory of measurement that are used in this study. The literature review in this study has led the researcher to come to the conclusion that although there is a great deal of literature on the representational theory of measurement, currently there are no other comprehensive sources on the principles of representational measurement other than the three volumes of measurement entitled *The Foundations of Measurement* by Luce *et al.* (1971, 1989, 1990). Although other sources of the principles of representational measurement, such as Stevens (1951), Luce and Narens (1994), Michell (1995), Decoene *et al.* (1995) and Narens (2002) will be consulted extensively in this study, the main sources will be the three volumes mentioned above.

In volume one of the *The Foundations of Measurement* (Luce *et al.*, 1971) consideration was given to structures having a natural concatenation operation, representable by a sum or by a weighted average, and structures in the combined effect of several factors on some one-dimensional, ordered attribute that is representable by an additive or a polynomial combination rule. In other words, volume 1 discusses measurement in only one dimension. In the present study, consideration is likewise given to measurement in one dimension. That is to say, consideration is given only to those attributes that do not involve multiple representations. Consequently, the principles of representational measurement discussed in volume 1 are relevant to this study.

Volume 2 (Luce *et al.*, 1989) of *The Foundations of Measurement* deals with multidimensional measurement. This volume discusses the principles of measurement that are used to measure an attribute that has many dimensions. According to Luce *et al.* (1989), common examples of multidimensional measurement occur in geometric representations. However, because of the large volume of principles of multidimensional measurement, these principles will not be

discussed in this study. They are, however, given as a recommendation for further study in chapter 14.

Volume 3 of *The Foundations of Measurement* (Luce *et al.*, 1990) deals with the concept of meaningfulness in measurement. It discusses the invariance of measurements under sets of circumstances. Attention is given to the concept of meaningfulness in the present study. The principles of meaningfulness outlined in this volume are applied to the accounting concept of measurement to evaluate whether or not current accounting measurements are meaningful.

It is also recommended by Luce *et al.* (1971) that for a scholar to understand the principles of representational measurement, he or she must be familiar with the elementary, and in some cases, where mathematical proofs are required, advanced mathematical material on sets, relations, functions, probability, abstract algebra, topology and calculus. The author did consult these materials for the purposes of this study. The reader too will need to be familiar with these mathematical materials in order to fully understand the principles of the representational theory that are outlined in the sections that follow.

2.4 The historical background of the representational theory of measurement

The developments in the theory of measurement can be traced back to the Greeks. But Helmholtz (1887) makes one of the earliest attempts to state explicitly, in terms of an ordered system with empirical operations, the collection of empirical laws that give rise to an additive numerical representation. A number of mathematicians and scientists, among them Holder (1901) and von Neumann (in von Neumann and Morgenstern, 1947), also clearly had the idea of axiomatizing ordered qualitative structures as possible models of empirical attributes and, in the latter two cases, of establishing, as mathematical theorems, the existence and uniqueness of numerical representations.

However, this approach was considered too general, and was not widely accepted by empirical scientists or philosophers of science during the first half of the 20th

century. This is evidenced by the discussions of measurement in, for example, Bridgman (1922, 1931), Campbell (1920, 1928), Cohen and Nagel (1934), and Ellis (1966). In a resurgence of interest in the middle part of the 20th century, which has extended to the present, this axiomatic style of studying the measurement of attributes was brought to the attention of non-mathematicians. Various improvements and generalizations of extensive measurement structures were developed. The most important pioneering works were the works of Suppes (1951), Scott and Suppes (1958) and Suppes and Zinnes (1963). The concept of measurement emphasized by these works focused on the representation and uniqueness theorems.

Under these two theorems, new ordered mathematical structures that appeared to have relevance to the measurement of certain attributes were isolated, and two theorems were established: the existence of a representation into or onto some prescribed numerical structure, and the uniqueness of that representation in the sense of formulating the class of transformations relating equally good representations into or onto the same numerical structure. This is the concept that has come to be known as the representational theory of measurement.

2.4.1 The underlying principles of representational measurement

2.4.1.1 Background to the representational theory of measurement

Before the development of the representational theory, the concept of measurement was based on the realist's perspective of measurement. According to the realist's theory, measurement is the discovery of numerical relations between magnitudes of some quantity and a unit magnitude (Michell, 1995:245). This suggests that the numerical relations discovered in measurement are taken to be logically independent of the measurers and their activities. This also means that the numbers assigned under the realist's perspective are intrinsic to circumstances. They are the empirical relations that are referred to in a

measurement situation. However, this view of measurement was particularly difficult to apply in the social sciences where numbers are sometimes external to the situations they are applied to. In other words, researchers in the social sciences were not able to verify whether the properties of the phenomena they were studying were identical to the properties of the numbers they assigned to them. A result of this was the development of the representational theory of measurement.

The representational theory of measurement (Luce *et al.*, 1971; Luce, *et al.*, 1990; Luce, *et al.*, 1989) is the most popular form of measurement theory in the social sciences. This theory is also known as the modern measurement theory. Its applications are particularly notable with respect to the development of methodology and theory construction in psychology (e.g., Coombs, 1983; Falmagne, 1992; Luce, 1992; Marley, 1991, 1992; Narens and Luce, 1993; Roberts, 1979). Consequently, these applications of this theory of measurement in the social sciences, particularly in psychology, have made it an indispensable part of the social sciences.

According to Narens (1985:5), representational measurement consists in specifying homomorphisms of some qualitative (or empirical) structure into a numerical one. This definition of representational measurement highlights that, for measurement to occur, there must be a specified qualitative structure, a homomorphism and a numerical relation structure. A homomorphism is a mapping between two algebraic structures in such a way that the result obtained by applying the operations to the elements of the first set is mapped onto the result obtained by applying the corresponding operations to their respective images in the second (Bhattacharya, Jain and Nagpaul, 1986:70). A homomorphism is thus a function that explains the transformation of an algebraic structure onto another algebraic structure. It is also evident that, in the absence of a homomorphism, it would not be possible to trace the path taken by an algebraic structure during its transformation into another algebraic structure. Consequently, in measurement it is necessary to know the type of algebraic structure that is used to represent the

property of an object during the process of measurement in order for this measurement to make sense. For example, it is important to know whether the height of an object is in centimetres or in metres.

Scott and Suppes (1958) assert that a primary aim of measurement is to provide a means of convenient computation. This viewpoint highlights the fact that the choice of a numerical structure to represent a specific empirical structure is strongly affected by considerations of computational convenience. It follows that the choice of homomorphism is also based on computational convenience. Adams (1966) points out that the representational theory of measurement is built on the basis that mathematical operations and relations are made to correspond to or represent empirical relations. This means that measurement occurs as soon as the empirical relational structure is represented by an abstract structure. Basically, the concept of representational measurement can be described as an attempt to understand the nature of empirical observations that can be usefully recorded, in some unique fashion, in terms of familiar mathematical structures (Luce and Suppes, 2001). Before any measurement can take place, therefore, it is necessary to fully understand the phenomenon that is being measured. It is thus clear that if accounting is to be considered a measurement discipline then accounting phenomena must be fully understood before measurement can take place.

2.4.1.2 The formal principles of the representational theory of measurement

This section includes some elementary definitions and concepts of measurement which are useful to reading the remainder of this study. However, the material in this section is not meant to be a formal or complete discussion of measurement theory. For such a complete discussion, the reader is invited to consult Luce, Krantz, Suppes and Tversky (1971, 1989, 1990).

It is important to note that for a measurement to be regarded as a representational measurement, it has to adhere to the principles of the representational theory of

measurement. Luce and Narens (1994) summarised the formal part of the principles of the representational theory of measurement and have reduced them to five main ideas that have been italicised below as follows:

1. *“A qualitative situation is specified by a (usually ordered) relational structure X consisting of a domain X , of infinitely many relations of X and infinitely many special elements of X .*

These relations, subsets, and elements are called the attributes of X . Measurement axioms are then stated in terms of the attributes of X . These axioms are intended to be true statements about X for some empirical identification and are intended to capture important empirical properties of X , usually ones that prove useful in constructing measurements of its domain, X .”

This extract highlights the point that precise knowledge of the object of measurement is necessary before any measurement can take place. In this case it is necessary to have adequate knowledge of a relational structure before any measurement can take place. According to Orbach (1978), a relational system consists of a set, and a set of relations defined on the set. This means that all the elements in the set are bound by the properties that are common to the members of the set. Furthermore, the extent to which every member of the set possesses a particular property is known with certainty.

The excerpt above also points out that true statements (axioms), that describe the empirical properties of the empirical relational structure, usually those that are useful in constructing measurements of the elements of the empirical relational structure, should be stated. This means that it is necessary to clearly state the property or the attribute that is of use and interest to measure before any process of measurement can commence. Luce *et al.* (1971) also point out that a set of axioms that is useful in the measurement of the attributes of an empirical relational structure must be treated as a set of qualitative laws. If this is the case,

it means that the attributes and relations of an empirical relational structure that are of use and interest to measure must be objective and empirically testable.

The explanation above further points out that the qualitative situation is specified by a usually ordered relational structure: the concept of order is preserved under monotonic transformations. A monotonic function is one that preserves a given order (Zimmermann, 1981). This suggests that the functions that transform the empirical relational structure onto the numerical relational structure must be order preserving. Stevens (1951) asserts also that the relations defining order must have three attributes: they must be connected, asymmetrical and transitive. These attributes are briefly discussed below:

- They must be connected- 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). This means that given any two elements in a set, a relation that is defined on the set must hold between the two given elements (see chapter 4).
- Asymmetrical- An asymmetrical relation is a relation that holds in one direction only. That is, the order of the relationship is unidirectional (see chapter 4).
- Transitive- A transitive relation is a relation that holds on more than two elements of a set without these elements having to be directly related. In a transitive relation there can be a relationship between the first and the second element of a set, and a relationship between the second and a third element that automatically implies a relationship between the first and the third element. For example, if **a** is related to **b**, and **b** is related to **c**, then **a** is related to **c** if the relationship is transitive (see chapter 4).

The existence of these attributes must be tested in order to confirm the existence of order. It can therefore be inferred from this discussion that if accounting is to be considered a measurement discipline, it is essential to specify accounting qualitative structures using relational structures that have specified domains,

elements and specified relations among the elements of the domain. Statements about the measurement of the attributes of accounting phenomena will then have to be made in terms of the elements and relations of the domain of the accounting qualitative structure. In section 2.3 it was noted that in every process of measurement it is necessary to know with certainty the object that is being measured. It was also argued that accurate knowledge of what is being measured gives measurement significance. This means that it should be possible to know what a measurement stands for. Therefore, the specification of the qualitative structure of an accounting phenomenon ensures that accounting measurements are significant.

The excerpt also notes that every measurement process should find a good axiom system. In addition, the extract asserts that the choice of the qualitative axioms is of fundamental importance in deciding whether the representational theory of measurement can be applied to a situation. According to Luce *et al.* (1971), a measurement system is not adequately understood if it depends on properties that are not explicitly recognized. Once they are explicit, deciding whether or not the same measurement procedure is applicable in a new domain is reduced to testing whether or not the requisite properties are satisfied. It also follows that the establishment of a good axiom system is necessary in deciding whether a theory of measurement is applicable to a situation or not.

2. "The representational theory requires that the primitives of X be given an empirical identification.

In particular, if R is an n-ary primitive relation on X, then it is required that the truth or falsity of R (xi...xn), for any particular choice of the n-tuples xi, be empirically decidable."

This excerpt indicates that each identified primitive of the empirical relational structure should be given an identification that can be tested empirically. Furthermore, it can also be inferred from this excerpt that each property of a class of objects that is of use and interest to measure must be unique and able to be empirically identified. This emphasizes the empirical nature of measurement. It

follows that there is no way of having a measurement process that is not empirical, given that the attributes that are being measured must be empirical. Luce *et al.* (1971) point out that the measurement axioms constructed from the primitives are regarded as a set of empirical laws. This implies that the primitives of the empirical relational structure from which the measurement axioms are constructed should also be regarded as a set of empirical laws. It can be further inferred that different properties of a class of objects cannot share the same empirical identity. Each property of a class of objects that is measurable must have a unique identity.

In chapter 1 it was noted (IASB, 2006; Wolk *et al.*, 2001) that accounting measurement focuses on the measurement of value. This means that it would be expected that value should be compatible with the principles of representational measurement. Since the extract above points out that the attribute that is the subject of measurement should have an empirical identity, then it follows that value should also have an empirical identity. An empirical identity of value is useful in the identification of value. With a specified empirical identity of value it is possible to test whether a particular measurement is indeed a measurement of value.

3. *“As much as possible, measurement axioms, stated in terms of the empirically identified primitives, should be empirically testable”*

This extract underlines that all the measurement axioms describing the measurement of the specified attributes of an empirical relational structure, should be empirically testable. This implies that the measurements that are constructed from empirically testable axioms must also be empirically testable. This reflects the objective nature of all measurements. It follows that if the empirical relational structure is objective, then measurements of the empirical relational structure must also be objective.

It should also be noted that the empirical testability of a measurement axiom is a matter of convention. Luce *et al.* (1990) point out that the idea of empirically

testing axioms is more closely associated with problems of statistical inference than with problems of axiomatizability. They also argue that the total set of structures admitting homomorphism into a particular numerical structure is very heterogeneous and may include instances that are difficult to describe. If this is the case, measurement axioms are an abstraction and they are subject to arbitrary conventions. It follows that their empirical testability is dependent on these conventions. It can further be inferred that the meaning of measurement axioms is dependent on conventions.

The IASB framework (2006, Para 83) for financial reporting, identifies cost and value as the attributes that are subject to measurement. This means that measurement statements in accounting are made only about cost or value, as they are the only identified attributes in accounting. The extract points out that, measurement axioms, stated in terms of the empirically identified primitives, should be empirically testable. If this is the case, it follows that measurement statements in accounting made about cost or value should be empirically testable.

4. *“Measurement of S is said to take place if and only if the following two theorems can be shown:*

- i. *(Existence Theorem). $S(x)$ is non-empty for each X that satisfies the measurement axioms.*
- ii. *(Uniqueness Theorem). An explicit description is provided about how the elements of $S(x)$ relate to one another. In practice this description usually consists of specifying a group of functions G for each 4 in $S(x)$. $S(x) = \{g^*4:g \text{ is in } G\}$, where $*$ denotes function composition.”*

This excerpt claims that the existence theorem and the uniqueness theorem are the most important principles of the representational theory of measurement. Luce *et al.* (1971) assert that the uniqueness and existence theorems are satisfied by the formulation of a set of sufficient axioms, which assert the existence of a homomorphism into a particular numerical relational structure and which specify the permissible transformations that also yield homomorphisms into the same

numerical relational structure. It is clear, then, that the existence theorem is satisfied if it can be shown that scaled values correspond to empirical phenomena. Hence, it can be concluded that the existence theorem is satisfied by testing whether the set of all elements that define the domain of the empirical relational structure is not an empty set.

The IASB framework (2006, Para 83) for financial reporting points out that an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured with reliability. This viewpoint identifies cost and value as the attributes that are the subject of measurement in accounting. The extract points out that the existence theorem focuses on testing whether the set of all elements that define the domain of an empirical relational structure is not an empty set. Thus, it can be inferred that the existence theorem in accounting should focus on proving whether cost or value truly exist for a given set of accounting phenomena.

The extract also asserts that the uniqueness theorem is proved by the specification of the type of transformations under which a scale is invariant. Churchman and Ratoosh (1959) also note that a number assigned to measure a property is unique once a unit of measurement has been chosen. Consequently, it can be concluded that the specification of the unit of measurement satisfies the uniqueness theorem. The specification of a unit of measurement clearly specifies the relationship between a measure and the attribute that is being measured. The unit of measurement also specifies how the elements of a particular set relate to one another with respect to that particular attribute.

According to Abdel-Magid (1979), monetary units are a measure of value in the accounting discipline. Since the extract points out that a number assigned to measure a property is unique once a unit of measurement has been chosen, this means that monetary units assigned to measure value are only unique once the unit of money is specified (e.g., Rand, Dollar, etc.).

5. *“The representational theory of measurement identifies empirical significance with meaningfulness.*

The concept of meaningfulness with respect to $S(X)$ is easily extended to numerical statements involving measurements of elements of the domain: meaningful statements are those whose truth-value is unaffected by the particular representation in $S(x)$ used to measure X .”

It is clear from this extract that representational measurement takes place if the measurements are meaningful. It is also clear that representational measurement regards meaningful statements as empirically significant statements. Churchman and Ratoosh (1959) point out 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. This means that a measurement is meaningful if it is clear what statements may be made about the measure that preserve its true meaning. It can also be inferred that a measure is meaningful if it reflects the true properties of the empirical relational structure.

The concept of meaningfulness originates from Stevens' (1946, 1951) typology of scales. In Stevens' (1946, 1951) typology the meaningfulness problem refers to the determination of the truth or falsity of statements based on comparisons of assigned scale values. This is done by determining the type of statistical procedures that may be carried out on the data structure without changing the scale of measurement on the data structure. Therefore, one can see that a theory of meaningfulness consists of giving necessary or sufficient conditions for meaningfulness. It follows that the essence of meaningfulness is embodied in the description of scale types and permissible statistics.

According to the IASB framework (2006, Para 99) for financial reporting accounting “measurement is the process of determining the monetary amounts at which the elements of the financial statements are to be recognized and carried in the balance sheet and income statement”. This means that monetary amounts are

used to represent the attributes of the elements of the financial statements. Monetary units are thus a measure of the attributes of the financial statements. It has been noted from the extract above that meaningfulness is concerned with the identification of the statistical procedures that may be carried out in a measure without changing the scale of measurement on the data structure. Therefore, this means that in the accounting discipline the concept of meaningfulness is concerned with the identification of the statistical procedures that may be carried out on the monetary amounts without changing the scale used in representing the attributes of the elements of the financial statements with monetary units.

2.5 The application of the representational theory of measurement

From the analysis of the representational theory of measurement above in section 2.4, it is clear that the choice of the qualitative axioms is of fundamental importance in deciding whether the representational theory can be applied to a situation. It should be pointed out that the choice of the qualitative axiom system depends on the individual performing the analysis. Scott and Suppes (1958) make it clear that the primary aim of representational measurement is to provide a means of convenient computation. The word “convenient” in this context implies a form of measurement that is handy to the user. Therefore, this makes the choice of the measurement method highly subjective and dependent on the user.

The representational theory of measurement only focuses on those relations that the experimenter wishes to represent with an abstract structure. For example, Decoene *et al.* (1995) claim that the qualitative axioms of an empirical situation are an abstraction and the empirical domain is rarely understood to such a degree that the chosen axioms will fit the regularities of the empirical domain perfectly. They argue that the ideal situation with respect to the qualitative axioms would be that only those axioms that have a direct and testable empirical content are chosen. This suggests that representational measurement only focuses on those attributes that one wishes to measure and not on everything else surrounding it. In chapter 1 it was noted that the objects of measurement are cost and value. It can

be inferred that it is not necessary to fully understand cost and value, but only those aspects of cost and value that are essential in their measurement. Therefore, it follows that accountants should focus on those relations of cost or value that they wish to measure.

One of the most important concepts introduced to measurement theory by the representational theory of measurement is the concept of axiomatization. Cliff's (1992) view is that the representational theory of measurement can best be understood as implying a new scientific thinking in which the advantages of axiomatization are of paramount importance. The purpose of the representational theory of measurement is to study the existence conditions of measurement structures and not the description and explanation of how actual measurement procedures arise in science as it is practised now (Decoene *et al.*, 1995). It investigates whether the properties and relations that are said to be on an empirical relational structure actually exist. All the assumptions made about a phenomenon in representational measurement must be shown to be true. Therefore, if cost and value are the objects of measurement, it can be inferred that all the assumptions about cost or value made by accountants must be shown to be true. Luce and Narens (1994) also make the point that the attributes of a phenomenon must be empirically decidable and the axioms that describe the measurement of these attributes must be empirically testable. It can therefore be concluded that all representational measurements must be objective. Consequently, it follows that measurements of cost and value in accounting must also be objective.

For Mitchell (1995), the view is that the representational theory of measurement equates measurement with numerical coding (albeit a complex variety where relations are numerically coded along with attributes). He argues that numerical coding always involves a conventional component: the agreement to code certain empirical attributes with certain numbers, and certain empirical relations with certain numerical ones. It is this component that is captured by the representation's uniqueness theorem. This suggests that every pair of the

representation and uniqueness theorems involves an arbitrary choice of a numerical relational structure. Stevens (1951) considers the concept of measurement as more immediately the goal of the experimental corner where the patient sifting of facts and relations has disentangled some of the relevant variables. The experimenter must have a good understanding of the phenomenon before measurement can take place. The choice of an appropriate qualitative axiom system depends entirely on a deep understanding of that part of reality one is studying. As a result, the choice of method of assigning numbers to the relations one has discovered entirely depends on oneself. It follows that in the accounting discipline the choice of the measurable attributes of cost or value is entirely dependent on the accountant who is performing the process of measurement. This accountant must thus have a good understanding of the concept of cost or value before measurement of these attributes can take place. Decoene *et al.* (1995) contend that when a domain is poorly understood, it is impossible to arrive at an explanation that suggests appropriate qualitative axioms. They also argue that there is no way of posing the question of measurement of a variable prior to an understanding of the structure of a variable. It is clear that the task of understanding the empirical domain of the variable belongs to the scientist. It follows that the representational theory of measurement is basically about proving representation and uniqueness theorems for the mapping of a given empirical relational structure into a formal relational structure, chosen by convention.

According to IASB (2006, Para 99), accounting measurement is the process of determining the monetary amounts at which the elements of financial statements are to be recognized and carried in the balance sheet and income statement. Since it has been noted (IASB, 2006) that the objects of measurement in accounting are cost and value, it can be inferred that measurement in accounting is the assignment of monetary units to represent the cost or the value of the elements of the financial statements. Therefore, in the accounting discipline, before a claim can be made that a particular measurement of the attributes of cost or value has been made, it is necessary to prove the representation and

uniqueness theorems for each mapping of the empirical relational structure of cost or value onto the monetary units.

2.6 Weaknesses of the representational theory of measurement

This section discusses the weaknesses of the representational theory of measurement. The shortcomings of representational measurement should not be perceived as the shortcomings of accounting. They are the shortcomings of representational measurement as a tool of measurement in the social sciences and not the shortcomings of accounting as a discipline.

One of the chief criticisms of the representational theory of measurement is its inability to deal sufficiently with the problem of error. A quantitative treatment of errors is impossible with the representational theory of measurement (Decoene *et al.*, 1995). This problem is related to the testability of qualitative axioms. The construction of numerical scales of measurement is subject to arbitrary conventions. The problem of error refers to the context, which involves difficult conceptual problems concerning the relation between detailed, inconsistent data and the abstraction derived from them, and the empirical relational structure (Luce *et al.*, 1971:13). It is clear from this that sometimes the experimenter might fail to observe exactly what he wishes to observe in the social sciences, because it is sometimes difficult to relate the observed phenomena to the observations made by the experimenter. It also suggests that social scientific phenomena are dependent on the opinion of the observer and, as a result, it is difficult to deduce whether the opinion of the observer is true or inaccurate. Hence, it is difficult to set a standard against which observations can be compared. It is thus not possible to establish the amount of error in an observation.

According to Decoene *et al.* (1995), in order to evaluate whether a given qualitative axiom is satisfied, the scientist needs data, and data inconsistencies with respect to a given qualitative axiom place a forced choice before the scientist. They argue that the scientist has to conclude that either the qualitative axiom is

not satisfied or the data are bad. It is evident from this that if the data given do not satisfy the axioms being tested it is difficult for the scientist to tell whether the axioms they are investigating do not exist in that data or whether the data they have is not representative of the phenomena they are studying. This problem is not dealt with by the representational theory of measurement when it is applied to the social sciences.

The second criticism of the representational theory is based on the idea that measurement is ontologically committed to the existence of quantities, independent of their measurement (Decoene *et al.*, 1995). They argue that since the representational theory of measurement is based on the idea that the purpose of measurement is to provide a means for convenient computation, then the representational theory of measurement is too liberal in what it considers to be measurements. It is clear from this that the representational theory of measurement does not limit measurements to only those that reflect the intrinsic properties of the object they are measuring, but also includes numerical assignments that do not reflect the intrinsic properties of the object being measured. Michell (1995) points out that the realist theory of measurement entails that Stevens' (1946) categories of nominal and ordinal scaling are not measurement. His argument is that these scales do not involve ratios between magnitudes of a quantity. This means that proving that numbers are existing entities proves the representational theory of measurement wrong. However, Mitchell (1995) also argues that if the underlying principle of measurement is numerical representation then there is no reason to exclude nominal scales. As a result, this study also views nominal scales as genuine scales of measurement.

2.7 Summary and Conclusions

It seems plausible to conclude from this chapter that the reason measurement theory has received so little attention from accountants may be explained in part by the fact that until recently a comprehensive theory of measurement for the social sciences was lacking. Luce *et al.* (1971, 1989, 1990) in their three volumes

of The *Foundations of Measurement* provide a comprehensive guide to modern measurement theory. This is the theory of measurement that is referred to in this study as the representational theory of measurement.

Although the representational theory began largely as a way of understanding the source of physical measurement it has provided useful applications to the behavioural and social sciences. As outlined earlier, the applications of the representational theory of measurement are particularly notable in the development of methodology and theory construction in psychology. Since both psychology and accounting are social sciences, it is reasonable to suggest that the representational theory of measurement can also form part of accounting methodology.

The principles of the representational theory of measurement validate whether a particular numerical assignment in social sciences can be described as a measurement. This indicates that the representational theory of measurement creates a norm for measurements in the social sciences to follow. The application of the representational theory of measurement to accounting practices to determine whether or not they reflect the properties of a true measurement system can thus be regarded as normative research.

The trends in accounting measurement research indicate that the perspectives of the accounting concept of measurement have not changed over the past sixty years. Views of the concept of measurement held by accountants sixty years ago have not changed much today. This indicates that no progress has been made in developing accounting measurement principles.

It is also clear from this chapter that it is necessary to specify the preformed theoretical constructs of the empirical relational system, the measurement function and the value of the measurement function. The specification of these ensures that the precise specification of the object of measurement, the numerical relational system onto which the object is mapped, and the scale of measurement is made before measurement can take place.

The main criticism of the representational theory of measurement is its inability to deal adequately with the concept of error. This problem is related to the testability of qualitative axioms. The construction of numerical scales of measurement is subject to arbitrary conventions. The problem of error refers to the context, which involves difficult conceptual problems concerning the relation between detailed, inconsistent data and the abstraction derived from them, the empirical relational structure. Sometimes an experimenter might fail to observe exactly what he intends to observe. As a result, measurements should always leave room for such errors of observation.

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 \mathbf{R} be a transitive relation on a set \mathbf{X} . \mathbf{R} is said to be transitive if $x \mathbf{R} y$ and $y \mathbf{R} z$ imply $x \mathbf{R} z$ for all x, y, z is an element of \mathbf{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.

Chapter 5-Representational measurement and the going concern assumption

5.1- Introduction

The establishment of the conditions under which a process of measurement is carried out is fundamental to an understanding of the measures it produces. Measurement literature (e.g., Luce *et al.*, 1971; Narens, 2002; Stevens, 1951) asserts that measurements should be evaluated with respect to the conditions under which they have been prepared. This is necessary since measurements may be made under non-standard conditions, such that comparisons or the evaluation of such measurements could lead to misleading inferences.

According to the IASB (2006) framework for financial reporting, accounting measurements that are necessary for the preparation of the financial statements of companies whose operations are expected to continue into the foreseeable future should be prepared under the going concern assumption. In other words, the construction of accounting measurements should take into account the effects of the going concern assumption. The going concern assumption asserts that unless there is evidence to the contrary, it is assumed that the firm will continue indefinitely (Wolk *et al.*, 2001:138). The going concern assumption is made when a company is ordinarily viewed as continuing in business for the foreseeable future with neither the intention nor the necessity of liquidation. It can be inferred from this that the going concern assumes a business that survives into the foreseeable future and that it assumes a successful business.

Sterling (1968) points out that financial statements prepared under the going concern assumption are provisional and the truth of these statements is dependent on subsequent events. This suggests that the truth of accounting measurements made under the going concern assumption is also dependent on subsequent events. However, Sterling (1979) believes that all measurements occur at a specific point in time. He argues that the purpose of measurement is to discover the magnitude at that point in time, regardless of what has gone before

or what will happen afterwards. This means that the truth of measurements cannot be dependent on subsequent events. Indeed, it is clear that if financial statements prepared under going concern are dependent on subsequent events, it is doubtful whether accounting measurement actually takes place under the going concern assumption. In chapter 1 it was established that for accounting to be considered a measurement discipline, its measurements should be in harmony with representational measurement. Evidently, it is also questionable whether the concept of measurement in accounting is in harmony with the principles of the representational theory of measurement when it is practiced under the going concern concept.

The purpose of this chapter, therefore, is to investigate whether the going concern assumption is in harmony with the principles of the representational theory of measurement.

This chapter begins with a discussion of the representational measurement implications of the going concern assumption, in section 5.2. This is followed in section 5.3 by a discussion of the representational measurement implications of the concept of flowing business activities. The chapter goes on to explain the effects of the concept of futurity in accounting on the principles of representational measurement, in section 5.4. The implications of the concept of time under the going concern concept on representational measurement are discussed in section 5.5. The effects of the entity concept on the application of the principles of measurement in accounting under the going concern postulate are covered in section 5.6, and the foundations of representational measurement under the going concern postulate in section 5.7. The conclusions in section 5.8 close the chapter.

5.2 The going concern postulate and representational measurement

In section 5.1 above it was noted (Wolk *et al.*, 2002:138) that the going concern postulate assumes that unless there is evidence to the contrary a firm will continue to exist indefinitely. It is clear from this that assets and liabilities are recorded in the financial statements on the assumption that the company will be able to realize its assets and discharge its liabilities in the normal course of business. The firm will also have to exist in the future so that it can receive its benefits from the realization of its assets and give up benefits in the settlements of its liabilities. Sterling (1997:498) puts it in the following way:

An asset is an asset because it will benefit the future and is valued on the present balance sheet on the basis of a past price. The firm will have to continue in the future in the manner expected at the present in order for the present allocations or past expenditures to be correct while the past allocations made on the basis of the past expectations of future events now need to be corrected to reflect present expectations of future events.

These words point out that an asset can only be considered to be such by a firm if the firm expects to continue for the foreseeable future. An asset can therefore only be classified as such under the going concern assumption. The extract also highlights the fact that financial statements prepared in the present under the going concern assumption do not contain empirical information. The information is provisional and has to be confirmed and verified at a future date. This perspective of going concern is in contrast to the principles of representational measurement. Narens (2002) asserts that all measurements must be a true reflection of the properties of the phenomena that they purport to represent. There must therefore be a one-to-one correspondence between measurements and the phenomena the measurements purport to represent. It is clear that the financial statements prepared under going concern cannot be empirically verified in the present and consequently they cannot be considered to be measurements. In chapter 2 it was noted that all measurable phenomena must be empirical. From this, however, it

can be concluded that accounting phenomena are not measurable under going concern.

Sterling (1979) believes that the determination of future economic benefits that are expected to be realized from assets and future economic benefits that are expected to be given up in settling liabilities is not a process of measurement. He argues that such a process is a forecasting process. This makes sense since the magnitude that is being quantified lies in the future. The use of the term “forecasting” indicates that the magnitude that is of interest in the present lies in the future. As a result, this magnitude cannot be empirically verified in the present. 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. It is evident from this line of reasoning that something that cannot be objectively determined cannot be measured. All future phenomena cannot be objectively determined, as they have not yet occurred. Thus, forecasts are not measurable. Therefore, values of assets and liabilities cannot be measured under the going concern postulates, as they are forecasts.

In addition, Sterling (1968:484) notes that income and position can only be estimated. He also argues that all statements prepared under going concern are provisional and dependent on subsequent events for the final and accurate statements to be prepared at liquidation. This means that under the going concern, the truth of accounting statements is dependent on future events. It is thus quite clear from this that the income statement and the statement of financial position are also dependent of future events. Luce *et al.* (1971:13) point out that the empirical relational structure should be seen as an objectively existing entity that is not bound by subjective assumptions of an individual. In other words, every empirical relational structure should be empirically testable. Therefore, if the information in the income statement and balance sheet under going concern is dependent on future events, this information cannot be considered to be objective. Hence it cannot be measurement information.

Paton and Littleton (1940) treated the going concern as an assumption and not as a factual statement. They argued that the going concern is of course a matter of assumption and this fact should not be lost sight of in the process of business reporting. An assumption is a belief or feeling that something is true or that something will happen although there is no proof (Hornby, 2005:77). No empirical evidence is required to make an assumption. Since the going concern is referred to as an assumption, then, this suggests that there is no proof of the existence of the going concern. It can also be inferred that there is no proof that the financial statements prepared under the going concern contain factual information. Thus, it is questionable whether financial statements contain measurement information.

As noted above (Sterling, 1968), in this section all statements prepared under going concern are provisional and inaccurate until the occurrence of some future events. Therefore, accounting measurements that occur under the going concern assumption cannot be considered an accurate reflection of the attributes of economic events. In chapter 2 the point was made that measurements should be a true representation of the properties of the objects that they purport to represent. Consequently, it follows that accounting quantifications that occur under going concern should not be considered as measurements.

Similarly, Gouws and Rehwinkel (2004:85) emphasize the view that it is not possible to produce accounting measurements under the going concern assumption when they state:

The going concern concept imposes the danger that the concept of time, and more specifically of the past and the future, can be incorrectly interrelated. Thereby the disclosure of reality over a given period or at a given point in time may be distorted. Since financial statements are prepared according to historical cost measurement procedures and simultaneously adhere to the futuristic going concern concept, a rather odd state of affairs is devised, namely that financial statement figures contain

provisional, estimated or contingent futuristic allocations that are based on historical cost measurements.

This extract underlines the point that financial reporting that occurs under the going concern concept incorrectly interrelates the time of occurrence of events. It also contends that figures relating to past and future events are aggregated to each other. Consequently, such an aggregation creates a result that reflects neither the past nor the future. According to Sterling (1997), measurement is the discovery of an extant position that requires a present act. He argues that future magnitudes can be predicted and verified as they occur, but that measurements need to be made in the present. According to this, future events are not measurable. It is also clear that only phenomena that currently exist are measurable. Accounting figures that represent future events are structurally different from those that represent past or current events. It can therefore be concluded that financial statements prepared under the going concern assumption are not in harmony with the principles of the representational theory of measurement.

5.3- Representational measurement and the flowing accounting events

This section discusses the concept of flow in accounting. Hawker (2003:236) describes flow as “moving steadily and continuously in a current or stream”. This means that the movement that is described as flow should be uniform and unbroken. According to Goldberg (2001:261), the concept of flow is primarily associated with liquids, but it can also be legitimately applied to gases and to granular substances such as sand or sugar. He also points out that the flow of occurrences which accountants take cognisance of is more analogous to that of a granular substance than that of a liquid or a gas. This viewpoint indicates that in a liquid, the constituent particles are homogeneous and they cannot be distinguished from each other structurally. Although gases and other granular substances can flow, their constituent particles are not homogeneous. They are distinguishable from each other structurally. It is evident that in this case the flow

in accounting is constituted by separate events that are not homogeneous. That is, accounting events flow through a business during its lifetime, but they are heterogeneous. Goldberg (2001:261) puts it as follows: “Each occurrence can be likened to a grain of sand and can be readily dissociated from any other, if need be, and does not merge and completely lose its separate identity in the totality of activity”. In other words, each accounting transaction is unique, separate and identifiable. It can also be reasoned from this that although different economic events keep their separate identities they have a homogeneous purpose. The purpose of economic events is to create profit for the business and it follows that the income from different economic events must be identical.

Kirk (2005) argues that under the going concern postulate a firm is assumed to continue indefinitely unless there is evidence to the contrary. It is also alleged that the true income of a firm cannot be calculated until the firm is dissolved (Sterling, 1968). Thus, one can infer that income can only be calculated once the flow of business activities has stopped. It follows from this that the going concern concept is necessary for flow of business activities. Moreover, the going concern concept is only possible if one assumes homogeneous business activities.

If individual business activities were viewed as independent and isolated, it would imply that the income produced from them should also be viewed as different. This view of business transactions makes income produced by all business transactions homogeneous. If, as outlined earlier (Sterling, 1968), the true income of an entity can only be measured at liquidation, it means that the creation of income is a continuous process, and at the point of liquidation, when it is possible to measure income, it would follow that all income has to be homogeneous. This perspective that suggests homogeneous income from business transactions is evidenced by the concept that all periodic income is aggregated to give the total income for the period.

If all business activities are seen as homogeneous, it would seem logical to assume that an identical method of measurement is used for measuring identical

attributes of different business activities. But evidence from accounting literature indicates that there are numerous measurement methods that could be used at the same time on different business transactions. For example, Staubus (1985:53) states:

If a scientist in a field far removed from accounting asked an accountant to tell him the central ideas of accounting measurement practices, what could the accountant say? Could he say that historical cost is the basis of accounting measurement? Surely he could not feel that he has conveyed the essence of the subject by reference to a principle that applies to a minority of balance sheet items.

This suggests that there are numerous methods of measuring the attributes of accounting phenomena. If this was the case, it would defeat the point of seeing the income they produce as homogeneous. It would make sense if periodic income were classified according to the different classes of transactions or activities that produced it. It is senseless to use different measurement methods on identical phenomena. It makes sense, however, to suggest that different business transactions produce different income. It would make sense, then, to employ different measurement methods for different phenomena.

Furthermore, Staubus (1985) contends that to his knowledge no one has woven accounting measurement practices into a comprehensive and coherent theory. This perspective highlights the fact that the underlying phenomena that are being measured are structurally different. That is to say, the phenomena themselves might be different and as a result they require different measurement methods and procedures. This leads to the development of different measurement theories for these phenomena. In addition, it should also be noted that there is no operation available in accounting that permits the aggregation of income produced by different accounting transactions. An operation that permits addition should indicate that the attributes that are used in the measurement of income are identical and that they are measured using an identical scale of measurement.

Luce (1996) also points out that the homogeneity axiom requires that numerical representations of elements that are structurally different cannot be added to each other. This emphasizes that it is necessary to verify that measurements on an identical scale are representations of an identical phenomenon before they are added to each other. In this case, it seems that the numerical representations of the attributes of accounting phenomena are structurally different. If they were added, it could lead to disharmony with the homogeneity axiom of extensive measurement.

5.4- Measurement and the problem of futurity in accounting

The problem of futurity in accounting is directly linked to the going concern assumption. The going concern postulate provides a context for valuation. Wolk *et al.* (2001:138) stress that the reporting of liquidation values for assets and equities is in violation of the postulate. This suggests that the values of assets and liabilities of an entity should be reported in the financial statements on a basis that reflects that an entity will be able to realize its assets and discharge its liabilities in the normal course of business. The entity therefore has to exist in the future in order to realize benefits from its assets and to discharge its liabilities. It also follows that the measurement of future benefits cannot occur in the present, as these do not exist.

The phraseology of the going concern concept implies stability of the firm and the economy. Sterling (1968) argues that the implementation of present plans under the going concern postulate requires that future events be much the same as expected, i.e. costs; prices, technology, etc. must remain fairly stable. This point of view highlights the importance of using expectations to represent magnitudes of future phenomena. It also indicates that under the going concern assumption expectations should be accurate predictions of the magnitudes of future events. But Sterling (1979) asserts that predictions are not measurements: future events do not represent reality and as a result their attributes are not measurable. Orbach (1978) believes that expectations have legitimate properties in the present

that are measurable. This suggests that the properties of expectations are real and are therefore measurable. But it should be noted that expectations of future events are not future events. Future events still remain immeasurable.

The going concern concept does not inherently mean continuing in an indefinite manner. No firm can continue forever. According to Sterling (1968), the length of continuity into the future is irrelevant to the going concern proposition. He argues that the significant point is that accountants are interested in the status of the firm at a given point in time in terms of its earning potential measured, to the extent possible, at the same point. It is this attempt to measure the earning potential of a firm at a given point in time that presents a measurement problem under going concern. Goldberg (2001) clearly points out that accounting transactions flow into the business entity until the point of liquidation. Before the point of liquidation, the accounting transactions flow non-stop through the business. As has been outlined above (Sterling, 1968), it is alleged that the true value of a firm is indeterminate prior to liquidation. Thus, legitimate properties of the income of the firm can only be obtained during liquidation.

Moreover, Sterling (1968) contends that present magnitudes under going concern are dependent upon subsequent events. He also argues that present magnitudes can never be known because subsequent events always lie in the future. This suggests that the measurement of the real attributes of accounting phenomena is only possible at liquidation. It follows that one cannot measure a magnitude that lies in the future: it is only the expectation that can be measured. It is not possible to independently verify a magnitude that lies in the future. Furthermore, 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 (Decoene *et al.*, 1995). Indeed, one can see that representational measurement is only possible with empirical phenomena. It is clear then from this that the measurement of future phenomena is definitely excluded.

Chambers (1997) notes, that, every particular measurement scheme requires the specification of the property of a class of objects that is of use and interest to the measure. A precise knowledge of the property that is being measured is thus necessary for measurement to occur. If a property lies in the future, a specific and precise definition of such a property in the present is impossible. One of the defining features of representational measurement is the belief that questions of measurement must be grounded in reality (Decoene *et al.*, 1995). It is quite clear from this that all measurable phenomena must be empirical. That is to say, they should all be objectively existing entities at that moment in the present. It is thus clear that it is not possible to measure a future property in the present.

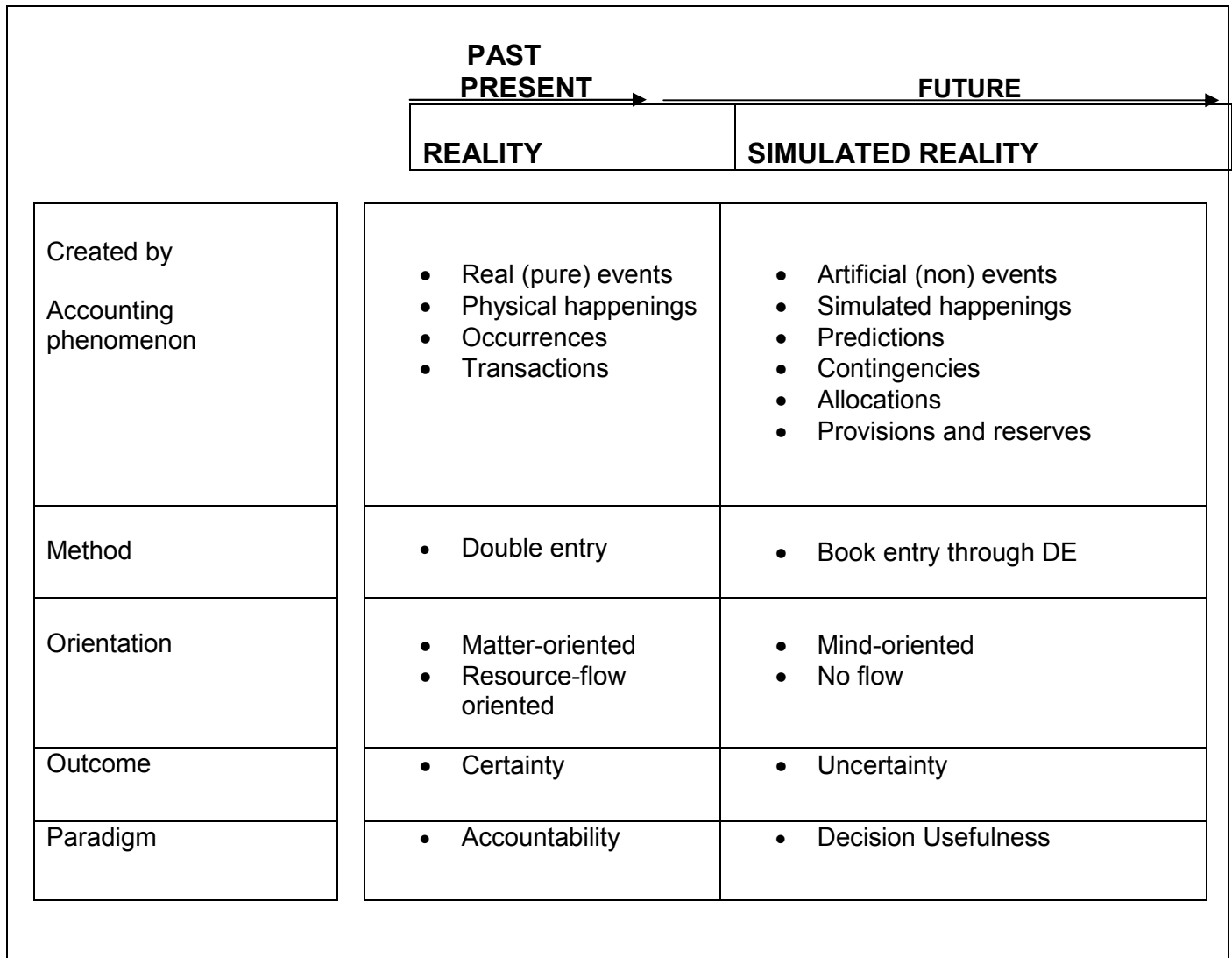
In addition, every particular measurement scheme requires the specification of a scale of some kind, making it possible to distinguish the extent to which every object in the class possesses the specified property (Chambers, 1997). This indicates that it is necessary to specify scales of measurement in a measurement process. It follows that it will be impossible to specify the scale of measurement for an unspecified property that cannot be empirically tested and that also lies in the future. A scale specifies the relationship between the empirical relational structure and the numerical relational structure. If a property lies in the future, its relationship with a numerical relational structure cannot be precisely specified. The reason for this is that a phenomenon lying in the future cannot be defined precisely as it does not exist. If such a relationship cannot be specified, measurement cannot take place. It is quite clear that the empirical relational structure of future events cannot be specified. It is only the expectations of future phenomena that have legitimate properties in the present that are measurable. In addition, it is not possible to specify the unit in the scale, and the conditions under which unit measurements shall be deemed to be of equal significance, as such measurements cannot be made.

5.5 The concept of time in accounting

The issue of time is of paramount importance in deciding whether or not the attributes of accounting phenomena are measurable. The classification of accounting phenomena is dependent on the concept of time. According to Gouws and van der Poll (2004), accounting phenomena are constituted by two types: namely: observed reality and simulated reality. They argue that time in accounting distinguishes between observed reality and simulated reality. The move from observed reality to simulated reality defines a change of time from the past to the present and to the future. In chapter 2 it was noted that the concept of representational measurement is applicable to phenomena that exist. It is clear then, that in accounting simulated reality is not measurable: it does not have attributes that are empirical. Only observed reality has attributes that are empirical and is therefore measurable.

The implications of the concept of time in accounting have been illustrated diagrammatically by Gouws' (2003) accounting arrow of time. Figure 5.1, which illustrates the arrow of time, was adapted from Gouws (2003). From this diagram it is clear that predicted or foreseen happenings become clearer as the future approaches. This is because our knowledge and information of the past comes from the fact that the procedures we use to arrive at beliefs about the past are generally more reliable than those generating predictions of the future (Gouws and Van der poll, 2004). As the future approaches different rules of employing the mathematical model of measurement in accounting measurement will be used. The arrow of time is illustrated in Figure 5.1 below:

Figure 5.1 Accounting arrow of time (Gouws, 2003:11)



Source: Gouws (2003)

The diagram indicates that in accounting, in the past and present, there are physical happenings, occurrences and transactions that represent reality. It is also clear from the diagram that reality can be empirically verified. The diagram also highlights that there is simulated reality in the future. The arrow of time also indicates that predictions, contingencies, allocations, provisions and reserves characterize accounting phenomena in the future, and that future phenomena are not based on reality. Consequently, future phenomena cannot be empirically verified, as they do not exist. In chapter 2 it was noted that measurement is

applicable to empirical phenomena only. Thus, accounting reality has attributes that are capable of being measured while simulated reality does not.

For measurement to occur it is necessary to have a full knowledge of the phenomenon that is being measured. Margenau (1959:165) points out that prior to measurement a precise theoretical construction of the attribute that is of use and interest to measure is necessary. That is to say, it is only the attributes of observed reality that are empirical and therefore they are measurable. With regard to simulated reality, the attributes of future events exist in the future and therefore, they cannot be measured in the present. Decoene *et al.* (1995) assert that 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 means that only existing phenomena are measurable. Orbach (1978:31) points out that expectations have legitimate properties at the present moment that are measurable. Future events have properties that lie in the future that cannot be empirically tested in the present and therefore are not measurable in the present. It is only the expectations of future events that can be measured in the present.

Decoene *et al.* (1995) emphasize that representational measurement requires the specification of an empirical relational system that can be represented by a numerical relational system. This requires an adequate understanding of the qualitative structure describing the attributes of the phenomenon to be measured. In order to form an adequate understanding of a qualitative structure, it is essential that the phenomenon being studied is empirical. But, if the phenomenon does not exist it cannot be fully understood. Caws (1959:8) notes in similar vein: "One has first a concept of some quality and looks afterward for quantitative expressions of it." It can be inferred from this that it is necessary to have precise knowledge of the object of measurement before measurement takes place. Once this precise knowledge has been established, one searches for a numerical relational structure that can be used to represent the attributes of the phenomenon. Therefore, if under going concern the attributes of accounting

phenomena lie in the future, the empirical relational structure of these accounting phenomena cannot be specified and as a result the numerical relational system that corresponds to the empirical relational system cannot be known. For these reasons measurement cannot be said to have taken place. Therefore, representational measurement cannot take place currently under going concern.

5.6- Representational measurement and the accounting entity

In chapter 2 it was noted (Luce *et al.*, 1971) that every pair of the representation and uniqueness theorems involves a choice of a numerical relational structure. It was also argued that the choice of this structure is a matter of convention and that the conventions are strongly affected by considerations of computational convenience. It is evident from this that the choice of a numerical relational structure is arbitrary, and varies with the viewpoint of the parties doing the measuring. It also follows that the proofs of the representation and uniqueness theorems for the measurement of value in accounting are dependent on an arbitrary choice of the numerical relational structure. It can also be inferred that the choice of a numerical relational structure that can be used to represent an empirical relational structure varies across different social settings. Moreover, in chapter 4 the point was made that the construction of a scale of measurement depends on the choice of a numerical relational structure. Therefore, if the choice of a numerical relational structure is arbitrary, this implies that the construction of a scale of measurement is also arbitrary.

In the discipline of accounting the choice of the numerical relational structure is also dependent on the accounting entity. According to Staubus (1985), the accounting entity is an economic unit under one management. He also argues that the scope of the management determines the boundaries of the entity. It can be inferred from this that the nature of the economic activities occurring in a business entity are dependent on the social context of that business entity. Tinker (1985) points out that the purpose of accounting is to resolve social conflicts. It follows that the nature of accounting measurement is dependent on

the type of social conflicts to be resolved. The choice of a numerical relational structure for a pair of the representation and uniqueness theorems in the measurement of the value of economic phenomena is thus also dependent on the type of social conflicts to be resolved. It is also evident from this that the construction of a scale of measurement is dependent on the wishes of management. One can go as far as to say that different economic entities may have different scales of measuring value. If the scales of measuring value are different for different entities, then value measurements made across these different entities cannot be compared unless they are converted to a common scale of measurement.

As has been noted in section 5.2 (Wolk *et al.*, 2001), the financial statements of entities whose operations are expected to continue indefinitely should be prepared under the going concern assumption. This indicates that the measurement of the values of the elements of the financial statements for a company whose operations are expected to continue indefinitely is also done under the going concern assumption. Sterling (1968) argues that the financial statements prepared under the going concern assumption are provisional and their truth is dependent on the occurrence of subsequent events. Sterling's argument suggests that the nature of accounting phenomena in the present, under the going concern postulate, depends on the occurrence of future events. That is, the empirical properties of accounting phenomena can only be known with certainty under the going concern postulate on the occurrence of subsequent events. If this is the case, the contents of financial statements prepared under the going concern postulate do not represent economic reality but rather a simulation of economic reality. It is only a speculation of what might happen in the future. Speculations are subjective and highly dependent on the view of the speculator. Consequently, the integrity of the information will suffer.

Luce *et al.* (1971) point out that it is only empirical phenomena that are measurable. This suggests that speculations about the future are not

measurable as they are not empirical. Earlier in this section (Staubus, 1985), it was noted that the scope of the management's influence determines the boundaries of the entity. This suggests that the wishes of management determine the nature of the speculations that are made under going concern. This makes expectations about future events highly dependent on the views of management. Consequently, measurement under the going concern postulate is highly dependent on the views of management.

The specification of a homomorphism in a process of measurement is specific to an entity. Luce *et al.* (1971: 13) highlight the fact that the numerical scales of measurement are subject to arbitrary conventions. They also argue that these conventions are strongly affected by considerations of computational convenience. Thus, it can be inferred from this that the measurement choices of an accounting entity are relative to a specific entity. Mattessich (1964:79) also classifies accounting measurements as measurements by fiat. This implies that accounting measurements are relative to a specific environment and consequently they should be evaluated relative to that environment. According to Stevens (1951), measurement is an especial preoccupation of psychophysics, not only in the narrow sense of the term, but in its older and broader spirit, which attempts to reveal rules relating the responses of organisms to the energetic configurations of the environment. This indicates that the general economic environment and the specific environment of a specific business entity affect accounting measurement, and that accounting measurements are unique to a specific entity.

Given the vast differences between firms (Sterling, 1968), it is difficult to conceive of identical conditions of measurement for of them. This view is consistent with the view that representational measurement equates measurement with numerical coding. Decoene *et al.* (1995) assert that numerical coding always involves a conventional component, that is, the agreement to code certain empirical attributes with certain numbers, and certain empirical relations with certain numerical ones. The use of the term "coding" indicates that a particular group of

people could agree to measure a phenomenon in a way that is unique and understandable to them. This suggests that individuals who are not part of that group might not be familiar with the coding system used by the group. Therefore, unless there is an agreement across different accounting entities, accounting measurements can never be common across them and consequently, they cannot be among different users.

5.7-The foundations of representational measurement under the going concern assumption

The discussion in this section focuses on the importance of foundations of measurement in a process of measurement on whether accounting measurement under going concern is based on foundations that can be empirically tested. According to Luce *et al.* (1971), every process of measurement must be based on specified foundations of measurement that can be empirically tested. In chapter 1 it was pointed out (e.g., IASB, 2006; Wolk *et al.*, 2001) that accounting is a measurement discipline and that accounting measurement occurs under going concern. If accounting measurement occurs under going concern, then there must be empirically testable foundations of measurement under going concern. Luce *et al.* (1971:13) argue that in analyzing the foundations of measurement one of the main concerns is formalization. They point out that in analyzing foundations there is a need to formalize the choice of an empirical relational structure as an abstraction from the available data, the choice of an appropriate numerical relational structure, the discovery of suitable axioms and the construction of numerical homomorphisms. These recommendations are discussed as follows:

- The choice of an empirical relational structure as an abstraction from the available data-The specification of an empirical relational structure is essential because it provides the empirical identity of the properties that are subject to measurement. Its formalization ensures that the individuals in that particular community of measurement are aware of the object of measurement. Such formalization guarantees that measurements are

meaningfully compared. Measurement symbolism must be agreed upon before measurements from different frames of measurement are compared.

- The choice of an appropriate numerical relational structure- The need to formalize a numerical relational structure ensures that the nature of the representation is familiar to the users of the measurement information. Luce *et al.* (1971: 13) point out that every pair of representation and uniqueness theorems involves a conventional choice of a numerical relational structure. They argue that these choices are entirely arbitrary and depend on the considerations of computational convenience. The use of the term “arbitrary” indicates that the numerical relational structure can be chosen without the use of any set rules or plans. This indicates that unless there is an agreement in measurement symbolism between different measurement frames, measurements cannot be compared.
- The discovery of suitable axioms- Axioms are true statements about the attributes of an empirical relational structure. They specify the true statements of the characteristic that is being measured. If axioms were not specified measurement would not be possible. The formalization of axioms ensures that the individuals in the same community of measurement have identical views about the characteristics of the empirical relational structure that are being measured. It facilitates the comparability of measurements in a community of measurement.
- The construction of numerical homomorphisms- A homomorphism is a scale of measurement (Luce *et al.*, 1971). A scale specifies the relationship between the empirical relational structure and the numerical relational structure. The formalization of the construction of homomorphism ensures that an identical scale of measurement is used by a particular group of people in the same community of discussion.

In the accounting literature, there are suggestions that the properties of accounting phenomena are not empirically testable and that it is thus not

possible to establish an empirical relational structure from accounting data. Heath (1987) asserts that notions such as income and owner's equity are concepts without any reality behind them. Since measurement is only possible with empirical phenomena, this suggests that they are not measurable under any circumstances. Sterling (1968:4) also claims that, "with rare exceptions accounting numerals do not represent phenomena, any phenomena". The use of the phrase "rare exceptions" suggests that many accounting phenomena are not measurable. Willet (1987) points out that the attribute that is currently being measured in accounting is not known. This indicates a representation problem in accounting. That is to say, it is not known what accounting quantifications represent. He argues that the only thing that is measured in accounting is the numerosity of monetary units, and it is not known exactly what this numerosity represents. It is evident from this that the rare exception of measurement in accounting is the numerosity of monetary units.

Goldberg (2001) argues that economic transactions flow into a business entity during its lifetime. The concept of "flow" introduces the idea of motion into the accounting discipline. This reflects the entrenched belief in the accounting discipline that accounting events are in motion. Ijiri (1989) attempted to base the foundations of accounting measurement on the physical laws of motion. This attempt to base the foundations of accounting measurement on the structure and terminology of laws of motion in physics is open to criticism. The initial criticism comes from the viewpoint that accounting is a social science and its foundations of measurement are currently not analogous to that of a natural science. Ijiri (1989) regards accounting wealth as corresponding to the physical quantity of mass times distance. This is not compatible with the representational measurement principles of additive conjoint measurement. For instance, according to Luce *et al.* (1971:245), the concept of momentum is a composite entity that is composed of several elements. They point out that their mass and velocity affect the attribute "momentum" of a physical object. Thus momentum is not a phenomenon that has a separate existence from its mass and its velocity. Rather, momentum exists as a result of the mass and velocity of the object. That

is, there is no apparent empirical relational structure of momentum. The empirical relational structures that are apparent in momentum are those of mass and velocity. Luce *et al.* (1971) believe that for momentum to be measurable, the two components that constitute it must be independently realizable. This means that these components (mass and velocity) must be capable of being measured independently of each other. In the determination of momentum, these two components can be measured independently (see, Luce *et al.*, 1971:246). Therefore, if wealth is a composite entity that is analogous to the physical quantity of mass times distance, then its components should be specified and they should be capable of being measured independently of each other, just like mass and velocity in the determination of momentum. But since it is not known currently what wealth is in accounting (McLean, 2006; Tinker, 1985), it is currently not possible to assert that wealth is measurable.

Ijiri (1989:85) also takes income momentum (called “momentum” = growth rate of wealth per time unit) to correspond to linear momentum (mass times velocity=mass distance per time). Currently, however, the quantity income momentum cannot be known because one of its components, “wealth”, is not known. Furthermore, there are no specifications of the attributes of wealth that correspond to mass and the attributes that correspond to distance when the analogy of wealth to mass times distance is made. The mass of an object remains constant while distance changes with motion. Therefore, what is constant in wealth and income is not specified in any way. From the discussion above, it seems that the mathematical principles of natural philosophy are not relevant to accounting measurement. It is also important to note that the concept of momentum is only applicable to a phenomenon that exists: only a phenomenon that exists can possess mass and velocity. Income is a non-existent phenomenon and cannot therefore possess momentum. For example, Stamp (1981) points out that, income is an ambiguous concept that is not an intrinsic property of an accounting entity. There is no agreement among researchers in the field of accounting on the meaning or relevance of income. The IASB (2006, Para 70) framework for financial reporting defines income as

follows: “Income is increases in economic benefits during the accounting period in the form of inflows or enhancements of assets or decreases of liabilities that result in increases in equity, other than those relating to contributions from equity participants.” If income is an enhancement of assets and the benefits from assets are enjoyed in the future, it means that the benefits of income also exist in the future and do not exist in the present (IASB, 2006). It follows that it is not possible to have an income momentum in the present. In addition, the concept of income cannot be precisely defined (Tinker, 1985; Stamp, 1981), but the particles in physics have a precise definition. This means that no meaningful analogy can be made between accounting phenomena and physical phenomena.

Gouws and Rehwinkel (2004:82) also assert that no meaningful analogy can be made between natural and man-made phenomena when they state:

The accounting product is a human artifact and not a natural phenomenon, which has more bearing on the classical sciences. Its product is art (hence the definition), a perception of reality.

This extract points out that accounting values cannot be inferred through natural laws: accounting values are not natural phenomena. It is clear that the properties of accounting values cannot be compared to the properties of natural phenomena. Accounting values cannot be measured using the same principles that are used to measure natural phenomena. Waldrop (1992:39) supports this view:

Classical science focuses on explanation and on laying bare the fundamental mechanics of nature. That is what biologists, geologists and astronomers do in their fields.

This points to the fact that natural phenomena can be inferred through natural laws, and that natural phenomena have characteristics that are different from artificial phenomena. It is thus clear that no sensible analogy can be made between natural and artificial phenomena. Consequently, there can be no analogy between accounting and classical sciences.

The discussion in this section presents the apparent lack of accounting measurement foundations. It seems that the accounting discipline is not clear on exactly what is measured in accounting. It is therefore not possible to classify accounting as a measurement discipline until such time that there is clarity on what is measurable and what is not in accounting.

5.8 -Summary and Conclusions

Literature in the discipline of accounting currently outlines that the going concern assumption is necessary for the preparation of the financial statements of an entity that is expected to continue in operation for the foreseeable future. Accounting literature also indicates that it is possible to measure the attributes of accounting phenomena under the going concern assumption. However, it has been argued in this chapter that this is in fact not possible. A summary of some of the main points is given below:

- Under the going concern principle, business activities are assumed to flow non-stop through a business entity until the point of liquidation.
- Income is considered to be an ambiguous concept that is not an intrinsic property of an accounting entity. As a result, there is no agreement among accountants about the meaning or relevance of income.
- The going concern concept assumes profitability. It has been argued that nobody would expect a firm that is continuously making losses to continue into the foreseeable future. The going concern assumption is only possible if one assumes that the status quo of business activities will be maintained in the future. The phraseology of the going concern concept implies stability of the firm and the economy. However, the fact that accounting phenomena have always happened in a certain way does not logically lead to the conclusion that this will be the case tomorrow. The problem with the going concern principle is that of generalizing from a limited number of observations. There are many unknown variables in the

future and as a result it is difficult to conceive that the business will continue in the future in the manner that is expected of it in the present.

- Assuming a going concern automatically implies the existence of a liquidating entity. Therefore, the intuitive beliefs that stem from the economic environment suggest the existence of a business world consisting of specific entities.
- The concept of measurement is only applicable to empirical phenomena.

The discussion in this chapter has highlighted the fact that many accounting variables are not directly observable as they lie in the future. Some authors have attempted to base the foundations of accounting measurement on the foundations of physics, but without success. Accounting is a social science and currently its foundations cannot be analogous to those of a natural science. As a result, it is necessary to develop foundations for accounting measurement that are based on its status as a social science.

Chapter 6- Measuring the values of accounting phenomena: An empirical challenge

6.1 Introduction

The area of accounting that deals with the determination of the values of elements of financial statements requires conceptual clarification. The difficulty lies in the general reference by the literature accounting to the measurement of value. The IASB framework for financial reporting (2006: Para 83) states that, “An item that meets the definition of an element should be recognized if the item has a cost or value that can be measured with reliability.” This suggests that value is measurable. It is also clear from this that a theory of value measurement exists in accounting. It can also be inferred that financial statements contain measurement information about the values of the elements of financial statements.

Contrary to this belief, however, is the fact that there is no evidence in the accounting literature to suggest that value can be measured. Instead, a critical analysis of accounting literature indicates that the values of the elements of financial statements are not measurable. In particular, there is consensus in the literature (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Paton and Littleton, 1940; Staubus, 2004; Sterling, 1966; Willet, 1987) that accounting researchers have not succeeded in creating a theory of accounting measurement from the observation of accounting practices of value measurement. Nor have accounting researchers currently succeeded in moulding accounting practices into a theory of accounting measurement.

According to authors such as Ryan *et al.* (2002) and Luce *et al.* (1971), every process of measurement must have an underlying theory of measurement. If this is the case, the lack of success by accounting researchers in creating a theory of accounting measurement suggests that accounting value is not currently being measured in the discipline. Authors such as Willet (1987) and Orbach (1978) point out that it is the amount of monetary units that are being measured in the

accounting discipline. This indicates that there is a theory of measuring monetary units but no theory for measuring value in accounting. On the other hand, authors such as Abdel-Magid (1979), Mattessich (1964) and Wolk *et al.* (2002) believe that monetary units are a measure of value in the financial statements. It is evident from this that there is a theory of value measurement in accounting that is based on the numerosity of monetary units. This creates confusion about whether or not the value of an element of the financial statement is currently measurable in the accounting discipline.

Value is outlined in the accounting literature (IASB, 2006; Wolk *et al.*, 2001) as the object of measurement in accounting. This means that a theory of accounting measurement depends on the ability of the accountants to measure value. The purpose of this chapter is to investigate whether accounting value is currently being measured in the discipline by comparing accounting principles of value measurement to the principles of the representational theory of measurement.

This chapter commences in section 6.2 with a brief discussion of the representational measurement implications of the concept of value. The credibility of monetary units as measures of value is discussed in section 6.3. This is followed in section 6.4 by a discussion that contrasts measurement to value indicators to highlight whether accounting practices of value measurement are measurements or indicators of value. The chapter goes on to determine in section 6.5 whether the bases of accounting measurement are in harmony with the principles of the representational theory of measurement. In the subsections of section 6.5 the credibility of the individual accounting bases of measurement and the principles of representational measurement is discussed. The measurability of the dimensions and qualities of the elements of financial statements is discussed in section 6.6. The subsections of section 6.6 cover the measurability of dimensions and qualities of the individual elements of the financial statements. Finally, conclusions close the chapter in section 6.7.

6.2 Applying the representational theory of measurement to the concept of value: The ambiguous nature of value

Value is currently described as the amount of money that something is worth (Hawker, 2003:678). In other words, the value in a commodity is the amount of monetary units that is paid to acquire a commodity. The measurement of value is currently fundamental to the preparation of financial statements in accounting. The basis of accounting measurement is based on the premise that value can be determined and measured objectively. This belief is reflected in current accounting literature. IASB (2006) points out that an item that meets the definition of an element should be recognized in the financial statements if it is probable that any future economic benefits associated with this item will flow to or from the entity, and if the item has a cost or value that can be measured with reliability. Abdel-Magid (1979) and Mattessich (1964) also point out that the value of a commodity is measured by the amount of monetary units paid to acquire it. This suggests that monetary units are a true representation of the scaled value of the value of a commodity. It would be expected that the accounting practices of value measurement would comply with the principles of the representational theory of measurement.

However, the nature of value is such that it cannot be measured objectively by the amount of monetary units paid to acquire a commodity. Authors such as Stamp (1981) and McLean and Ryan *et al.* (2002) contend that value is a subjective concept. This means that value cannot be objectively determined. Authors such as Dobbs (1937) and Tinker (1985) also note that the concept of value lacks invariance and that all theories of value do not facilitate the comparability of different value measures. They argue that a theory of value must provide a single metric that allows comparisons to be made. This means that currently there is no theory of value that facilitates the comparability of different measurements. It follows that current theories of value give rise to numerous metrics for value measurement. Similarly, Ryan *et al.* (2002) note that there is no general agreement relating the amount of monetary units paid to acquire a commodity and

the amount of value in a commodity. It would seem that the relationship between monetary units and value cannot be empirically verified. If this is the case, it is clear that it is not possible to verify independently the amount of value that is represented by a particular quantity of monetary units. Consequently, the concept of value cannot be empirically identified nor can the axioms stated in terms of the concept of value be empirically tested. This indicates that the qualitative structure of value and its properties are not invariant. Indeed, it is clear that the qualitative structure of value varies with the agreement of the parties to the transactions.

This lack of invariance of the value of an accounting phenomenon is also reflected at an auction. For instance, different amounts of monetary units can be offered for a commodity. This reflects the fact that different individuals have different perceptions of value. As a result, it is difficult to determine whether the different amounts of monetary units offered for a commodity reflect the idea that different individuals see different amounts of value in a commodity, or that different amounts of monetary units are paid for the same amount of value. There is a serious difficulty in attempting to measure value in order to establish a scale which relates certain amounts of value to a particular quantity of monetary units. The amount of value in a commodity exists in the mind of the parties to the transaction and it changes with the opinion of those parties, and therefore value is not invariant.

Invariance is a concept that is fundamental to the establishment of the representation, uniqueness and the meaningfulness principles of modern measurement theory (Luce *et al.*, 1990). The representation principle is satisfied in a process of accounting measurement if it can be empirically verified that a particular numerical relational structure represents a specific empirical relational structure. But in the accounting discipline the relationship between monetary units and value is not known. It is clear, then, that it is currently not possible empirically to verify that monetary units represent the value of a commodity. The uniqueness principle is satisfied in a process of measurement once the unit in the scale of measurement is specified. However, in the accounting discipline the scale of

measuring value is not specified. This suggests that monetary units assigned to represent the value of a commodity are not unique. In chapter 2 it was noted that measurements are meaningful once a scale of measurement is specified. It follows then that the concept of meaningfulness is satisfied in a process of accounting measurement if the scale of measurement is specified. But it has also been noted in chapter 4 that in the accounting discipline there are no specified scales for measuring value. Monetary units can therefore not be meaningful measures of value. If invariance is absent in the concept of value it means that value is not measurable.

Wittmann (1956) also questions the claim by the accounting discipline that monetary units are a measure of the value of a commodity. He argues that value cannot be determined independently except through recourse to a phenomenon (price paid) that it ought to explain. It is evident from this that the process of value measurement is reversed: Instead of being able to determine price by way of value, the magnitude of the value has to be deduced from the price. There is definitely a need for a scale of value from which units of value can be matched against the amount of monetary units that ought to be paid for them. The process of measurement is possible only in the presence of a scale of measurement. Therefore, the amount of monetary units cannot be a measure of the value of a commodity unless an accounting scale of value is specified.

A review of the work of Debreu (1959) and Arrow and Debreu (1954) demonstrates the lack of attention given to the relationship between the amount of monetary units paid to acquire a commodity and the amount of value in a commodity. In both these studies the amount of monetary units paid to acquire a commodity is considered to be a measure of its value. No discussion is provided of the association between the value of a commodity and its price, apart from the revelation that a price is paid in order to acquire a commodity at market equilibrium in a perfectly competitive market. There is no specification of exactly what the price represents. In addition, there is no specification of the measurement axioms that describe how value is represented by the amount of

monetary units paid for the commodity, so that they can be empirically tested. Furthermore, value should not be induced from the amount of monetary units paid for the commodity, but the amount of monetary units to be paid should be induced from the amount of value in a commodity. This is because the principles of the representational theory of measurement require the specification of the attribute that is of use and interest to measure, before any measurement can take place (Luce and Narens, 1994). Therefore, the point of view in the accounting discipline of “measuring” first, before the specification of the attribute to be measured, is certainly not consistent with the principles of the representational theory of measurement.

Tinker (1985) notes that value is one of the most frequently used terms in accounting vocabulary. He claims that the concept of value is not adequately defined in accounting and few accountants understand the meaning of value. Accountants do not know the precise meaning and definition of value. In chapter 2 it was noted that the object of measurement must be known precisely before measurement can take place. Unless accountants know the meaning of value precisely, it will not be possible for them to measure value.

Discussions about value in the accounting literature also reflect that value is subjective. Sabine (1987) claims that the concept of value is like beauty: he argues that value is in the eye of the beholder. Similarly, Smith (1956) argues that the value of a dollar bill is not an absolute quantity but depends more on the circumstance in which it is exchanged. It can be inferred from this that if value is like beauty, the concept of value lacks a precise definition as it exists in the perception of an individual. Bohm (1983) contends that what is thought about has an existence that is independent of the process of thought. He argues that while an individual can create and sustain an idea as a mental image by thinking about something, the individual does not create and sustain a real thing in this way. Ideas created in the mind of an individual do not represent reality. It follows that it is not possible to create a reality from thinking about the concept of value. That is to say, value does not come into being by thinking about it. Consequently, it can

be inferred that value is not real but a creation of the mind. Value cannot therefore be given an empirical identification.

Decoene *et al.* (1995) point out that one of the defining features of the representational theory of measurement is the belief that questions of measurement must be grounded in how reality is structured. This suggests that the empirical relational structure of a phenomenon must be known before it is measured. If this is the case, the principles of representational measurement cannot be applied to the measurement of accounting value, as it is not real. Value cannot be given an empirical identity and so it is not measurable. Therefore, it can be concluded that monetary units cannot be a measure of value.

6.3-The credibility of monetary units as measures of value

It is believed by accountants that exchange value is measured in an exchange transaction by the monetary numerosity at the time of exchange. Abdel-Magid (1979:355) puts it as follows:

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.

This points out that the amount of monetary units paid to acquire a commodity is considered to be a measure of the commodity's value. This means that monetary units represent the properties of value. It should be noted that the numerosity of monetary units is based on the system of counting, which is based on extensive measurement (see, Luce *et al.*, 1971). Therefore, the extract is suggesting that exchange value can be measured through extensive measurement. At the time of exchange the equality of ratios can be verified. Ratio scales preserve relative ratios (Stevens, 1951). This also suggests that value is measured on the ratio scale by the numerosity of monetary units. It is clear that accounting literature views value as a phenomenon that is measurable on an extensive scale.

However, this thinking is flawed by the fact that the amount of currency in an exchange transaction measures the numerosity of monetary units and not value. It is true that value is believed to be an important variable influencing the amount of currency that can be paid for a commodity, but it is incorrect to say that the amount of currency paid for a commodity is a measure of value. The problem with the use of currency as a measure of exchange value is that exchange value is ambiguous and not an intrinsic property of an accounting entity (Stamp, 1981). The concept of measurement is applicable to phenomena that can be empirically verified. Phenomena that cannot be empirically verified cannot be measured, because it is not possible to specify a scale of measurement for phenomena that are not empirical. Without a scale of measurement there can be no agreement among the users of the measurement information on how a numerical relational structure relates to an empirical structure. As a result, there can be no general agreement among accountants on the relationship between monetary units and value. It follows that attempts to assign scale values of monetary units to the value of a commodity create a representation problem. This gives rise to numerous indices of the exchange value of the same commodity. The problem with these indices is that they are not monotonically related.

The concept of monotonicity is fundamental to extensive measurement. Luce *et al.* (1971) point out that the existence of the monotonicity or the homogeneity axiom is a necessary condition for extensive measurement. No extensive measurement can occur in the absence of the monotonicity condition. From Luce's (1996) perspective, homogeneity is the view that particular elements of a specified set cannot be distinguished structurally from one another. If this is the case, it follows that the perspective that value is a subjective property suggests that indicators of value from different individuals are structurally different from each other. Therefore, it can be concluded that statements involving the measurement representations of value are subjective because they depend on the opinion of the measurer.

It should also be noted that the ratio scale character of the monetary unit measurement is based on the numerical representation of monetary unit intervals so that the value associated with the concatenation of adjacent intervals is the sum of values associated with those intervals. However, this does not mean that the number of monetary units as a measure of accounting value is also a ratio scale. The subdivision of the amount of currency paid for a commodity into small intervals defined by the monetary unit has, as far as is known, nothing empirically to do with exchange value. Ryan *et al.* (2002) point out that the pound sterling or the dollar has a standard scalar but there is no agreement relating them to a concept of value. This means that, currently, value is not known in accounting. Therefore, the intuition that exchange value can be represented numerically is pre-theoretical. There is a ratio scale for the measurement of the amount of monetary units, but there is no independent theory for the measurement of value, except for the pre-theoretic conjecture that exchange value is a monotonic function of the amount of monetary units. Therefore, it can be concluded that it is necessary to have a theory of value measurement first, before monetary units can be regarded as a measure of value.

6.4- Measurements versus indicants

The debate in section 6.3 suggests that physical measurements are used in the accounting discipline in a way that does not engage the full measurement structures that underlie them. In this case, monetary units are thought to be an order-preserving index of a hypothetical underlying quantity (value), which itself has not received full measurement analysis. Such indices are not measurements. They fall under the category of indicants. Indicants are effects or correlates related to psychological dimensions by unknown laws (Stevens, 1951). These indicants are commonly confused with measures in accounting. Abdel-Magid (1979) confuses an indicant with a measure when he argues that the property subject to measurement in an exchange transaction is exchange value, which is measured by the monetary numerosity at the time of exchange. In this case, the relationship between value and the number of monetary units paid for the value is

not known. Value is a hypothetical quantity that has not received full measurement analysis. An agreement among participants in a process of measurement about the relationship between an empirical relational structure and the numerical relational structure used to represent it implies the presence of a scale of measurement. According to Willet (1987), there is no agreement relating monetary units to value. This suggests that there is no scale of measurement in accounting that relates monetary units to value. Furthermore, in section 6.2 it was mentioned that value is subjective. It is clear that value is a hypothetical quantity whose empirical structure is not yet fully understood. As a result, there is no general agreement among accountants on the relationship between monetary units and value. It can thus be concluded that value is currently related to the quantity of monetary units by unknown psychological laws.

Measurement only occurs when the relationship between the indicant and the dimensions of the entity in question are known (Stevens, 1951). Stevens also argues that the difference between an indicant and a measure is that the former is a presumed effect or correlate that bears an unknown (but usually monotonic) relation to some underlying phenomenon, whereas the latter is a scaled value of the phenomenon itself. This indicates that measurements are verifiable while indicants are not. In addition, 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 (Decoene *et al.*, 1995). It is clear then that a measure of a phenomenon emerges from an explicit theory into which that phenomenon is incorporated. All indicants are thus pre-theoretical.

Since Staubus (1985) points out that researchers in accounting have not succeeded in developing a comprehensive and coherent theory for the measurement of value, it can be inferred from the above discussion that so-called accounting measurements are not measurements at all but indicants. It should be noted that there is nothing incorrect in the use of indicants in a discipline. Luce *et al.* (1990) point out that the use of indicants for pre-theoretical variables may be a

useful initial step towards such a theory but should not be confused with the measurement of the variable. The use of indices may eventuate in the dissolution of the hypothetical variable into many related concepts as the theory about its measurement develops. The confusion that is currently prevalent in the discipline accounting arises from the fact that the amount of monetary units that is paid for the value of a commodity is considered to be a measure of the value of that commodity, but is instead merely an indicant. It is recommended that the accounting discipline should drop the claim (e.g., Abdel-Magid, 1979; IASB 2006) that it is capable of measuring value until such time that a theory of value measurement has been developed in the field.

6.5 The bases of accounting measurement

6.5.1 Elements, attributes and the bases of accounting measurement

Every measurement discipline requires the precise specification of the object of measurement. Narens (2002) supports this when he says that it is essential to specify the qualitative structure of the object of measurement before measurement can take place. It is clear from this that one must have precise knowledge of the object of measurement. Furthermore, Luce and Narens (1994) point out that measurement refers to the measurement of the attributes of objects and not the objects themselves. But it seems there is confusion in the accounting discipline as to whether it is the objects themselves or the attributes of these objects that are being measured. In outlining the principles of accounting measurement the IASB's (2006, Para 99) framework for financial reporting states:

Measurement is the process of determining the monetary amounts at which the elements of the financial statements are to be recognized and carried in the income statement and balance sheet. This involves the selection of the particular basis of measurement.

This underlines the fact that the properties of monetary units are used to represent the elements of the financial statements. It is evident that the extract above does not specify the attributes of the elements of financial statements that are represented by the monetary amounts. In this case, it can be argued that the elements are considered to be attributes that are the subject of measurement. It follows that what needs to be specified are the objects whose attributes are the elements of the financial statements. The IASB's (2006:Para 83) framework for financial reporting also outlines that an item that meets the definition of an element of the financial statement should be recognized if the item has a cost or value that can be measured with reliability. The value or the cost of an element is the attribute that is the subject of measurement in accounting and not the element itself. This creates confusion as to the exact identity of what is being measured in accounting. It is not clear whether cost or value can be equated with an element of financial statements or whether it could be that cost or value are attributes of the elements of financial statements.

The extract above also points out that the assignment of monetary units to accounting phenomena is guided by the selection and use of a particular basis of accounting measurement. A basis is defined as "a foundation or a support" (Hawker, 2003:48). If there are bases of accounting measurement then there are foundations of accounting measurement. However, accounting research (e.g., Chambers, 1997; Orbach, 1978; Staubus, 2004) indicates that there are no foundations of accounting measurement. This casts doubt on the existence of bases of measurement in accounting. Therefore, given the confusion about whether or not bases of measurement exist in accounting, it follows that it is necessary to determine whether such bases are compatible with the principles of the representational theory of measurement.

6.5.2-The historical cost basis of accounting measurement

The IASB's (2006) framework for financial reporting considers the historical cost concept as one of its bases of accounting measurement. It was noted in section 6.5.1 that measurement in accounting is the process of assigning monetary units to the elements of financial statements. According to the IASB (2006:Para 100) framework for financial reporting, historical cost is a basis of accounting measurement that prescribes that assets should be recorded at cash paid at date of acquisition and liabilities at the amount of proceeds received in exchange for the obligation or the amount of cash expected to be paid to satisfy the liability. This perspective holds that the monetary units paid to acquire an asset are a measure of the value of an asset. It is also clear from this that the amount of proceeds received in exchange for an obligation or the amount of cash expected to be paid to satisfy the obligation is also considered to be a measure of the value of a liability. It is evident from this that under the historical cost basis, monetary units paid to acquire an asset are considered to be a measure of the value of that asset and the amount of monetary units received in exchange for an obligation is considered to be a measure of the value of a liability. If this is true, historical costs would be expected to be compatible with the principles of representational measurement.

In chapter 2 it was noted (Luce *et al.*, 1971) that a basis of measurement should specify the domain of the measurement function, the measurement function and the value of the measurement function. Therefore, if the historical cost basis of accounting measurement is the basis for this assignment of monetary units to the value of assets and liabilities, it can be inferred that the historical cost basis should specify these characteristics. The characteristics are discussed in relation to historical cost as follows:

- **The domain of the measurement function-** In every process of measurement the domain of the measurement function must be specified. According to Luce *et al.* (1971), measurement cannot take place unless the domain of the measurement function is known with certainty. If the object of

measurement is known with certainty, the domain of a measurement function is known. Narens (2002) points out that the domain of a measurement function is known if the qualitative structure of the phenomenon to be measured and all its attributes are known. This implies that if the historical cost concept is a basis of measurement, it must have a specified domain of a historical cost measurement function. However, accounting research has indicated that there is no specified attribute that is of use and interest to measure under the historical cost basis of measurement. Willet (1987) asserts that it is not known what the monetary amounts in the financial statements represent. This indicates that the object of measurement in accounting is not known. Orbach (1978) argues that measurement theory requires the specification of at least one empirical attribute that induces a non-metrical order on the assets or liabilities such that the order is preserved by the historical cost function. He notes that no such specification is made by historical cost. It is therefore clear that the historical cost basis of accounting measurement falls short of the requirements of representational measurement.

- **The measurement function-** In every process of measurement it is necessary to specify the measurement function. A measurement function is a scale of measurement (Narens, 2002). It specifies how an empirical relational structure is mapped onto a numerical relational structure. Luce *et al.* (1971) point out that every process of measurement must have a scale measurement. A scale of measurement specifies the relationship between the numerical relational structure and the empirical relational structure. If this relationship is not known, measurement cannot take place. Authors such as Ryan *et al.* (2002:118), Chambers (1997) and Willet (1987), note that the relationship between monetary units and the value of an element of the financial statement is not known. The absence of a specified scale between monetary units and value indicates that the measurement function

is not specified in accounting. It is evident from this that the historical cost concept is not a basis of measurement.

- **The value of a measurement function-** The value of a measurement function indicates the type of representation of the empirical relational structure. Luce *et al.* (1990:267) believe that a measurement is unique once the unit of measurement has been specified. The value of the measurement function indicates the units of measurement. These units of measurement make a particular measurement representation meaningful. For example, the height of a person is meaningless unless a particular representation is specified, e.g., centimetres or metres. In the accounting discipline the abstract structure onto which the value of an element of the financial statements is mapped is monetary units. This indicates that statements about the measurement representations of the value of an element of the financial statement are meaningless unless the units of measuring value are specified. Authors such as Willet (1987), Chambers (1997) and Ryan *et al.* (2002) have noted that there are no units of value measurement. It is therefore clear that the historical cost basis does not specify the units of measuring value in accounting.

The discussion above indicates that the historical cost concept has not specified the domain of the measurement function, the measurement function nor the value of the measurement function. Narens (1985) believes that representational measurement consists in specifying homomorphisms of some qualitative (or empirical) structure into a numerical one. This viewpoint highlights the point that the specification of homomorphisms is a necessary condition for measurement. In chapter 2 it was noted (Bhattacharya, Jain and Nagpaul, 1986) that a homomorphism is a mapping between two algebraic structures in such a way that the result obtained by applying the operations to the elements of the first set is mapped onto the result obtained by applying the corresponding operations to their respective images in the second. For a homomorphism to be specified, the

domain of the measurement function and the abstract structure onto which the domain can be mapped must be known. The attribute that is being measured should be specified in order to verify whether the measurement process has appropriately mapped the structure of the attribute. One can see that a lack of specified attributes of measurement in accounting makes it impossible to know whether the mapping preserves the structure of the attribute that is measured.

Representational measurement theory also requires that the object of measurement should be given an empirical identity (Luce and Narens, 1994). This means that if the attributes that are useful to measure are not specified, they cannot be empirically identified. Furthermore, it will also be impossible to formulate measurement axioms that are useful in accounting measurement. Measurement axioms can only be formulated if the domain of the measurement function is known. In the case of historical cost, the domain of the measurement function is unknown. It can therefore be concluded that a lack of a specified attribute of measurement in accounting (e.g., Chambers, 1997; Ryan *et al.*, 2002; Staubus, 2004) means that it is not possible to verify the existence of homomorphisms in accounting measurement that map the value of an element of financial statements onto the monetary units.

It should be pointed out that the historical cost basis of accounting measurement does not recognize the difference between the domain of the measurement function and the measurement function itself. The recording of assets at cash paid at date of acquisition indicated above in this section (IASB, 2006) makes historical cost the value of a measurement function. But there is no specified measurement function in the accounting literature that has historical cost as its value. Jones and Walker (2003) assert that historical cost is an attribute of an asset or a liability. This assertion makes historical cost the domain of the measurement function. This indicates that the accounting discipline is not sure of the identity of historical cost. This highlights the problem of representation in accounting. According to Luce and Suppes (2001), representational measurement takes place if and only if the representation and uniqueness theorems can be proved. If these theorems

cannot be proved under the historical cost basis, it is not possible for historical cost to be a basis of measurement.

6.5.3 The current cost basis of accounting measurement

The formulation of the current cost concept under the IASB's (2006) framework for financial reporting has little regard for the principles of the representational theory of measurement. Current cost is one of the bases of accounting measurement (IASB, 2006). Specified foundations of measurement under the current cost basis of measurement would therefore be expected to be in place.

According to the IASB (2006), current cost represents the amount of cash or other considerations that would be required to obtain the same asset or its equivalent. Current cost thus refers to the amount of monetary units that are assigned to the value of an asset. One would expect there to be a well-defined procedure for assigning monetary units to the value of an asset. Without such a procedure that establishes the equivalence between monetary units and the value of an asset, any such assignment would be arbitrary. The perspective that, under the current cost basis of measurement, assets are recorded at the amount of cash that would have to be paid to acquire the same or equivalent asset (IASB, 2006) reflects that current costs are the value of the measurement function that maps the value of an asset onto the monetary system. The problem with this is that there is no specification of the measurement function that maps the value of an asset onto the monetary system. Ryan *et al.* (2002:118) point out that there is no agreement that relates monetary units to the value of an accounting phenomenon. This indicates that in the accounting discipline there is no agreement on the measurement function that maps value onto the monetary system. It can therefore be concluded that current cost is not a basis of measurement.

Other authors have also noted that current costs are not measures of anything. Willet (1987) notes that there is no property that is measured by the financial statements apart from the numerosity of monetary units, and that it is not known exactly what the numerosity of monetary units represents in accounting. This

highlights the problem of representation in accounting. According to Orbach (1978), measurement theory requires that at least one empirical attribute that induces a non-metrical order on the assets or liabilities such that the order is preserved by the current cost function be specified, whereas no such specification is made by current cost. As in the case of the historical cost basis, the current cost basis presents a representation problem.

Furthermore, the current cost basis of accounting measurement is a measurement basis for an attribute that does not exist. IASB (2006) points out that an item that meets the definition of an element should be recognized in the financial statements if it has a cost or value that can be measured with reliability. This indicates that the attributes that are of use and interest to measure in accounting are cost or value. An individual has a choice of whether to measure: cost or value. It is evident from this that if cost and value were different the accounting literature (IASB, 2006) would not have given such a choice as the measurement of cost would have reflected completely different properties from those of value measurement. If they were different the accounting literature would have specified the conditions under which either cost or value could be measured. Currently, there is no such specification in the accounting literature. It can therefore be inferred that cost and value have identical properties. According to Luce *et al.* (1990), the attribute that is the subject of measurement should be empirically testable. Therefore, if cost and value are the subject of measurement in accounting, they should also be empirically testable. However, authors such as McLean (2006), Tinker (1985) and Willet (1987) have pointed out that value and cost are subjective concepts that cannot be empirically tested. This implies that value and cost do not have an existence that can be empirically tested. Since measurement theory requires that the attribute that is being measured should be given an empirical identity (Luce and Narens, 1994), it can be concluded that current costs are not a measure of value in accounting.

6.5.4-The net realizable value basis of accounting measurement

The concept of a net realizable value basis of accounting measurement hinges on the premise that a market can be obtained for an asset or a liability. In this case the market value is taken to be the measure of the value of an asset or a liability. IASB (2006: Para 100) describes net realizable value as the amount of cash or cash equivalent that would be obtained by selling the asset currently, or that would currently be paid to redeem the liability. The act of measurement (see Abdel-Magid, 1979; Wolk *et al.* 2001), occurs at the time of establishing the amount of monetary units that would be obtained if the assets were to be sold currently or paid if the liability were to be redeemed. However, the amount of cash or cash equivalent that would be obtained by selling the asset currently or that would be paid to redeem the liability currently cannot be considered to be a measure of the value of an asset or a liability. It is not known exactly what the numerosity of monetary units represents in accounting (Willet, 1987). This indicates that the object of measurement is not known: so it is also not known exactly what the numerosity of monetary units represent under the net realizable value basis of accounting.

The viewpoint that it is not known exactly what the amount of monetary units represents implies that there is no specification of the qualitative structure and the attributes of the value of an asset or a liability. Narens (2002) adds that an empirical relational structure and its attributes must be specified for measurement to occur. Therefore, the lack of a specified qualitative structure of value implies that it is not known how monetary units represent value under the net realizable value basis of accounting. Thus, the net realizable value cannot be a basis of accounting measurement.

6.5.5-The present value basis of accounting measurement

The present value concept is also outlined in the accounting literature as one of the bases of accounting measurement. The IASB (2006: Para 100) framework for financial reporting points out that under the present value basis of measurement,

assets are recorded at the present discounted value of the future net cash inflows that the items are expected to generate in the normal course of business. The IASB (2006: Para 100) framework also points out that liabilities are carried at the present discounted value of the future net cash outflows that are expected to be required to settle the liabilities in the normal course of business. It is clear from these points that the expectations of future cash flows are assigned to the attributes of assets and liabilities. According to Orbach (1978:31), expectations have legitimate properties at the present moment which can be measured; they have empirical properties that are testable in the present. This gives the impression that present values are bases of measurement.

However, present values cannot be measures of the attributes of accounting phenomena. For instance, as has been outlined earlier (McLean, 2006), value is a subjective concept that cannot be empirically tested. This implies that value is not measurable. From Luce and Narens' (1994) point of view the representational theory of measurement requires that the attribute that is of use and interest to be measured should be given an empirical identification and the measurement axioms stated in terms of the attribute should be empirically testable. Since value does not have empirical properties that are currently known, it follows that value is not measurable under the representational theory of measurement.

Furthermore, Luce *et al.* (1971) assert that the empirical relational structure and its empirical properties should be treated as invariant. They point out that a set of axioms leading to the representation and uniqueness theorems may be regarded as a set of qualitative empirical laws. If value is an ambiguous concept that is not an intrinsic property of an accounting entity, it cannot be given an empirical identity or be empirically testable. It also follows that statements about the determination of value cannot be considered to be qualitative empirical laws. It can be further inferred from this that if the present value is not empirical its existence cannot be proved. This presents a representation problem. According to Luce and Narens (1994), representational measurement takes place if and only if the representation and uniqueness theorems can be proved. It is not known

exactly what the expectations of future cash flows represent. It should be noted that expectations of future cash flows are genuine measures of the expected inflow of future monetary units, but they are not measures of value. Therefore, from this discussion it can be concluded that the present value basis of accounting measurement is not consistent with the principles of the representational theory of measurement.

6.5.6-The fair value basis of accounting measurement

The fair value concept is currently considered to be one of the bases of measurement in accounting. Fair value is defined as the amount for which an asset could be exchanged in an arms-length transaction (Kirk, 2005:330). In this case, the amount of monetary units paid to acquire a commodity is considered to be a measure of the value of a commodity. However, it should be pointed out that it is only the amount of monetary units that are measured under the fair value, not the value itself. Ryan *et al.* (2002:18) point out that there is no agreement relating the amount of monetary units paid to acquire a commodity and value. This indicates that different amounts of monetary units can be used to represent the same amount of value. It is thus impossible to specify homomorphisms that preserve the empirical relational structure of value on an abstract structure of monetary units.

Added to this, there is no scale of value that relates the amount of monetary units paid to a particular quantity of value. But the principles of measurement require the specification of a scale of measurement (Narens, 2002). The scale of measurement relates the units of value to the monetary units. In the absence of a scale it is not possible to know the extent to which a particular commodity possesses the characteristic of value. It follows that fair value falls short of adherence to the principles of the representational theory of measurement.

6.6-The elements of financial statements

Financial statements are frequently described as portraying measurement information about the financial position, performance and changes in the financial position of an entity. According to the IASB (2006) conceptual framework for financial reporting, financial statements portray the financial effects of transactions and other events by grouping them into broad classes according to their economic classes. Measurement in accounting hinges on the measurement of characteristics of elements of these different economic classes of transactions and events. The elements of financial statements have been outlined by the IASB's (2006) conceptual framework for financial reporting as assets, liabilities, equity, income and expenses.

Research in accounting (e.g., Chambers, 1997; Ijiri, 1975; Ryan *et al.*, 2002; Staubus, 1985; Staubus, 2004) indicates that the attributes that are of use and interest to measure in the accounting discipline are not clearly stated in the accounting literature. The measurable dimensions and qualities of the different economic classes of the elements of financial statements are not known. This casts doubt on the belief that the elements of financial statements have measurable attributes. Furthermore, there is consensus (e.g. Ijiri, 1975,1967; Gilman, 1939; Littleton, 1953; Paton and Littleton, 1940; Staubus, 1985; Sterling, 1966) that the accounting discipline has not succeeded in creating a theory of accounting measurement from the observation of practices of measurement in accounting. This suggests that accounting is a measurement discipline that does not have a theory of measurement. However, every process of measurement must have such a theory (Ryan *et al.*, 2002). It is clear then that it is doubtful whether, currently, the elements of financial statements have measurable attributes. The lack of success of accounting researchers in creating a theory of accounting measurement suggests that the dimensions and qualities of the elements of financial statements might not be consistent with the principles of representational measurement.

6.6.1 The dimensions and qualities of assets

The dimensions and qualities of an asset can be inferred from its existing definition. The existing IASB (2006, Para 49) framework's definition of an asset is as follows:

An asset is a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity.

This definition indicates that an asset is a resource that is controlled by an entity in the present. The resource and the right to control it exist on the date of the financial statement. From the representational measurement perspective (Luce et al., 1971) the attributes of the resource and the right to control it exist currently and therefore they are measurable. In measuring these attributes, they must be identified and an empirical identity assigned to them. Currently, accounting research (e.g., Chambers, 1997; Staubus, 2004; Vollmer, 2006) indicates that such attributes are not specified in the literature. If attributes of an asset are to be measurable they have to be specified. It is also clear from the definition above that the concept of an asset also depends on the future benefit theory. This theory indicates that an asset can only exist if future economic benefits are expected to flow to an entity from the asset. Consequently, in order for one to prove the existence of an asset one must focus on the identification of a future inflow of economic benefits. Sterling (1968) also points out that the notion of future benefits gives accounting a forward-looking direction. If this is the case it can be inferred that the firm has to exist in the future in order to receive the benefits.

It should be pointed out that the future attributes of future economic benefits are not measurable in the present: the attributes of future economic benefits cannot be empirically tested in the present. On the other hand, expectations of future economic benefits are measurable. Orbach (1978:31) makes the point that expectations can be measurements because they have legitimate properties at the present moment, which can be measured. Nevertheless, it should be

highlighted that an expectation is different from the real attribute that is in the future and therefore, although the expectation can be measured, the future attribute cannot be measured in the present. As a result, future phenomena are not measurable.

The principles of recognizing the elements of financial statements in the financial statements bring another dimension to the measurement of the attributes of an asset. According to IASB (2006), an item that meets the definition of an element of the financial statement should be recognized in the statement if it is probable that any future economic benefits associated with the item will flow to or from the entity, and if the item has a cost or value that can be measured with reliability. It follows that for an asset to be recognized in the financial statement its cost or value must be capable of being measured with reliability.

Evidence in the accounting literature suggests, however, that the value of an asset cannot currently be measured. For example, Ryan *et al.*, (2002:118) point out that there is no agreement relating the concept of value to the amount of monetary units used to represent it in accounting. Yet, according to the principles of representational measurement (Luce and Narens, 1994), measurement takes place if and only if the representation and the uniqueness theorems can be proved. In chapter 2 it was noted that the existence theorem focuses on proving whether the attributes and the relations specified by an empirical relational structure actually exist, and whether the associated numerical relational structure onto which the specified relations can be mapped actually exists. The uniqueness theorem is proved by the specification of the type of transformations under which a scale is invariant. Consequently, if the relationship between the amount of monetary units assigned to represent the value of an asset and the value itself cannot be specified, it is impossible to prove the representation and uniqueness theorems of the representational theory of measurement. In chapter 2 it was also noted that the representation theorem of the representational theory of measurement is proved once the scale of measurement is specified. But if the relationship between monetary units and value is not known, it is not possible to

specify the scale used in measuring value. Again in chapter 2 it was noted that the uniqueness theorem of the representational theory of measurement is proved once the unit in the scale of measurement is specified. But, if the relationship between monetary units and value is not known, it is not possible to specify the scale used to measure value and consequently it is impossible to specify the unit in the scale used to measure value.

6.6.2 The dimensions and qualities of liabilities

The dimensions and qualities of a liability can also be inferred from its existing definition. The IASB's (2006 Para 49) framework for financial reporting defines a liability as follows:

A liability is a present obligation of the entity arising from past events, the settlement of which is expected to result in an outflow from the entity of resources embodying economic benefits.

This definition reveals that a liability has qualities that have existed in the past, and that are in the present and that will exist in the future. The use of the phrase "present obligation" in this definition implies that the economic burden and the obligation exist on the date of the financial statement. From the perspective of the representational theory of measurement (Luce *et al.*, 1971), the attributes of the economic burden and the obligation that exist are measurable as long as the process of measurement complies with the principles of the representational theory of measurement. One of the necessary steps in the measurement of these attributes is their identification and the assignment of an empirical identity to them. Currently, accounting research (Chambers, 1997) indicates that such attributes are not specified in the accounting literature.

It is also clear from the definition above that the existence of a liability hinges on the future benefit theory. This definition indicates that a liability can only exist if there is an expected outflow of economic resources from the entity. Expectations have legitimate properties in the present (Orbach, 1978). In other words,

expectations have properties that are empirically testable in the present. It follows that expectations have properties that are identifiable in the present. Luce *et al.* (1971) points out that it is only empirical phenomena that are measurable. Therefore, the properties of expectations are measurable in the present. But the actual attributes that will exist in the future and which do not exist now are not measurable. As noted in chapter 2, it is only empirical phenomena that are measurable. Thus, it can be concluded that expectations of liabilities are measurable.

The principles for recognizing the elements of financial statements also bring another dimension to the measurement of liabilities. According to the IASB (2006), an item that meets the definition of an element of a financial statement should be recognized in the financial statement if it is probable that any future economic benefits associated with it will flow to or from the entity, and if it has a cost or value that can be measured with reliability. However, accounting value is not currently measurable. According to Ryan *et al.* (2002:118), there is no agreement relating the concept of value to the amount of monetary units used to represent value in accounting. Yet the principles of representational measurement require the specification of the relationship between the empirical relational structure and the abstract structure. This suggests that the value of a liability is currently not measurable in accounting. It is therefore necessary to specify the relationship between monetary units and the value they are intending to measure.

6.6.3 The dimensions and qualities of income

The concept of income depends on both the going concern concept and the liquidation concept. IASB (2006, Para 70) defines income as “increases in economic benefits during the accounting period in the form of inflows or enhancements of assets or decreases of liabilities that result in the increases in equity, other than those relating to contributions from equity participants”.

This definition ties the attributes of income to those of assets and liabilities. It is clear that income is defined as a variation in the attributes of assets and liabilities

that bring a positive change to the assets and liabilities of a business. Therefore, if income is taken to represent increases in economic benefits during an accounting period, other than increases in assets or decreases in liabilities, it may be argued that the increase in economic benefits represents something that has happened. Since measurement is the assignment of numbers to empirical phenomena according to rules (Stevens, 1951), it looks as though it is possible to measure the attributes of the increase in economic benefits during an accounting period once the rules of representational measurement have been complied with. However, the applicability of the representational theory of measurement to the measurement of income is constrained by the viewpoint that income is ambiguous and not an intrinsic property of an accounting entity (Stamp, 1981:23) This makes income a hypothetical phenomenon that is not backed by reality. It follows that income is dependent on the opinion and assumptions of an individual or accountant. As a result, there can be no consensus among accountants on the nature of the qualitative structure of income or its measurability.

Furthermore, Kam (1990:69) remarks, “income is based more on accounting constructs than on economic reality”. A construct is an idea or a belief that is based on various pieces of evidence which are not always true (Hornby, 2005: 312). This means that income is not real even at liquidation. Gouws and van der Poll (2004) also suggest that when income is determined under accrual accounting, personal judgements regarding deferrals, allocations and valuations are taken into account. If this happens in the determination of income it means that income is a subjective phenomenon. This suggests that the attributes of income are not empirically testable.

The qualities of income mentioned above have serious, negative implications for the measurement of income. If income is a subjective concept that is based on constructs rather than on reality, it is a creation of the mind. The axioms about the measurement of income cannot be empirically tested and the attributes of income cannot be given an empirical identity. The principles of the representational theory of measurement (Luce and Narens, 1994) require that axioms about the

measurement of a phenomenon should be empirically testable and that attributes of the phenomenon be given an empirical identity. Furthermore, it is not possible to prove the representation and uniqueness theorems from the perspective of the representational theory of measurement. In chapter 2 it was pointed out that representational measurement occurs if and only if the representation and uniqueness theorems are proved. It is thus quite clear that the attributes of income cannot be considered measurable.

6.6.4 The dimensions and qualities of an expense

The nature of the concept of an expense is such that it asserts the view that representational measurement is not part of the traditional accounting methodology. IASB (2006) defines expenses as “decreases in economic benefits during the accounting period in the form of outflows or depletions of assets or the incurrence of liabilities that result in decreases in equity, other than those relating to distributions to equity participants”.

This defines expenses in terms of a change in the attributes of assets or liabilities. If expenses are defined as depletions of assets or incurrence of liabilities, then it may be inferred that they are bound by the measurement rules governing assets and liabilities. The use of the term “future economic benefit” in defining assets and liabilities clearly indicates that what is of interest to an asset or a liability is the future, and therefore expenses are also future oriented.

The future implies uncertainty and this leads to the use of probability theory (Hampton and Bishop, 1998). However, there is no probability version of a measurement theory. The uncertainty of future events implies that they cannot be known with absolute certainty. Yet, according to Decoene *et al.* (1995), 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. This makes it clear that measurement pertains to objectively existing phenomena that can be empirically tested: it

follows that the attributes of future events are not measurable. Decoene *et al.* (1995) argue that choosing an appropriate qualitative axiom system depends entirely on a deep understanding of the part of reality that one is studying. This means that it is not possible to have a deep understanding of future events in the present. It was mentioned in chapter 2 that the existence and uniqueness theorems could only be proved on the empirical relational structures of phenomena that actually exist. The existence and uniqueness theorems can clearly not be proved on the empirical relational structure of an expense.

The concept of an expense may be broader than the future benefit theory. For example, the Committee on Terminology (1957:3) explain it as follows: “Expense in the broadest sense includes all expired costs which are deductible from revenues.”

This definition represents the traditional revenue expense orientation. The deduction of expenses from revenues implies that identical attributes of revenues and expenses are measured. However, there is no specification in the accounting literature of the attributes of expenses and revenues that are the subject of measurement for the purposes of matching. As a result, these attributes are not empirically testable. Vickrey (1970) comes to the conclusion that there is no property that is measured in accounting apart from the numerosity of monetary units. Exactly what the numerosity of monetary units represents is unknown, however. This violates the representation and uniqueness theorems (see chapter 2) of the representational theory of measurement. Given this, it follows that revenues and expenses cannot be meaningfully added or subtracted.

In addition to the above, accountants arbitrarily allocate costs to products (Hampton and Bishop, 1998). In other words, the allocation process is not based on an identifiable attribute. A measurement process is arbitrary when another numeral could have been assigned instead. Furthermore, no conclusive argument is invoked to defend the numeral that was actually chosen. Allocation is not measurement because it is not empirically testable (Sterling, 1979). As a result,

models for allocating expenses to products do not correspond to any real life phenomena. These allocation models are not theoretical because they do not help to explain observations or empirical phenomena. In chapter 2 it was underlined that all processes of measurement must have an underlying theory of measurement. Allocations do not qualify as processes of measurement as they do not have an underlying theory to support them.

6.6-5 The dimensions and qualities of equity

The dimensions and qualities of equity can also be inferred from the existing definition. The IASB's (2006 Para 49) framework for financial reporting defines equity as follows:

Equity is the residual interest in the assets of the entity after deducting all its liabilities.

This definition indicates that liabilities are subtracted from assets to produce equity. This subtraction suggests that the attributes of liabilities and the attributes of assets that are subtracted are identical and are measured on the same scale. However, accounting research (e.g., Chambers, 1997; Ijiri, 1975; Staubus, 1985; Walker and Jones, 2003) indicates that the attributes of the elements of financial statements that are of use and interest to measure are not specified. If this is the case, it will be impossible to verify whether the attributes of assets and liabilities that are being measured are identical. These attributes might be structurally different and as a result the operation of subtraction cannot be applied between them. Furthermore, Ryan *et al.* (2002:118) points out that there is no agreement relating the concept of value to the amount of monetary units used to represent it in accounting. It is clear from this that the rules that were employed in assigning monetary units to value are not known. It is thus impossible to know whether the rules employed in determining the amount of monetary units assigned to the value of an asset are the same as those applied in assigning the amount of monetary units to the value of liabilities. This would seem to make equity immeasurable.

6.7-Summary and conclusions

The concept of value is fundamental to the accounting discipline. Accountants believe that value can be measured. However, it has been shown that attempts by researchers in accounting to create a theory of accounting measurement from the observation of the so-called accounting measurement practices have not succeeded. But every measurement system must have a theory of measurement which includes the objectives of a measurement process. This lack of success in creating a theory of accounting measurement suggests that accountants are currently not measuring the value of accounting phenomena.

This chapter comes to the conclusion that the amount of monetary units paid to acquire a commodity is not a measure of value. It has been established in this study that the theory of measurement that is applicable to the accounting discipline is the representational theory. This chapter underlines that the nature of value is such that the domain of the measurement functions that should map the empirical relational structure of value cannot be specified, which is not consistent with the principles of the representational theory of measurement that requires the specification of the domain of the measurement function.

Foundations of measurement are fundamental to every measurement discipline. One of the main concerns in analysing the foundations of measurement in a measurement discipline is formalization. This involves the choice of an empirical relational structure as an abstraction from the available data, the choice of an appropriate numerical relational structure, the discovery of suitable axioms and the construction of numerical homomorphisms (Luce *et al.*, 1971). Consequently, every measurement discipline must have formalized foundations of measurement.

Currently, accounting is regarded as a measurement discipline. Accounting literature reveals that there are no formalized foundations of accounting measurement. An analysis of the bases of accounting measurement reveals that they do not contain any foundations of measurement. This suggests that they are

not in fact bases of measurement. Furthermore, it has been established in this chapter that the existence and the uniqueness theorems of the representational theory of measurement cannot be proved on the bases of accounting measurement.

A summary of some of the main points follows:

- The current cost basis, the historical cost basis, the net realizable value basis, the present value basis and the fair value basis of accounting measurement are not bases of measurement. They are not compatible with the principles of the representational theory of measurement.
- Present values are probabilistic in nature because of their future orientation. But there is no probabilistic version of measurement theory or the related statistical methods for evaluating whether or not a data set supports or refutes specific measurement axioms. Furthermore, there is no specification of the attribute that is the subject of measurement under present value.
- Before it can be considered measurable, an empirical relational structure has to satisfy certain preconditions under the representational theory of measurement. These include the specification of the attributes, subsets and relations among the attributes of the empirical relational structure. Accounting literature (e.g., IASB, 2006; Wolk *et al.*, 2001) refers to the measurement of the elements of financial statements. In this study it has been found that the dimensions and qualities of the elements of financial statements are not measurable. Attempts to prove the representation and uniqueness theorems on some examples of accounting measurement, particularly the relationship between monetary units and value, have not been successful. This suggests that the dimensions and qualities of the elements of financial statements are currently not being measured.

The discussion in this chapter revealed that value is not measurable, and that there are no foundations of accounting measurement. It was also shown that elements of financial statements currently do not have measurable attributes. Therefore, it can be concluded from this chapter that there are no foundations for accounting measurement.

Chapter 7-Objectivity and the accounting concept of measurement

7.1. Introduction

The concept of objectivity is fundamental to all measurement. Boyce *et al.* (1994) points out that measurement should be objective in its communities of discussion. Measurements must be made in the same way by all the individuals in a specific community of reference. It follows from this that measurements are socially constructed. Luce *et al.* (1971:13) also point out that the empirical relational structure and its associated empirical properties formulated as axioms should be invariant. They contend that a set of axioms leading to the representational and uniqueness theorems of fundamental measurement may be regarded as a set of qualitative (that is, non-numerical) empirical laws. It can be inferred from this that the objects of measurement themselves should be viewed in the same way by all individuals, irrespective of their frame of reference. This also means that, given the structure of physical attributes, any physical law that is defined in terms of these attributes must also be invariant. Numerical representations of objects of measurement must therefore be objective in the same way as the underlying object of measurement.

However, given that there is consensus (see chapter 1) that the accounting discipline has not succeeded in creating a theory of accounting measurement from the observation of accounting practices of measurement, it can be inferred that the objectivity of the accounting concept of measurement is questionable.

The purpose of this chapter is to investigate whether the accounting concept of measurement can be considered objective in the light of the principles of the representational theory of measurement.

In this chapter a discussion of the role of perception in accounting measurement is provided in section 7.2, followed by an exploration of the objectivity of cost and value in section 7.3. In section 7.4, an examination of the objectivity of the qualitative structures of accounting phenomena is conducted. The chapter goes

on in section 7.5 to discuss the implications of the concepts of public objectivity and empirical objectivity on accounting measurement, in section 7.6. A discussion of the implications of the concept of formal objectivity in accounting measurement is provided in section 7.7. The chapter closes in section 7.8 with the conclusion.

7.2 The role of perception in the concept of measurement in accounting

The phenomenon of vagueness and ambiguity has been observed in the accounting discipline by many accounting researchers. For example, authors such as Zebda (1991), Stephens *et al.* (1985), Cooley and Hicks (1983), Kaplan (1982), Horngren (1982), Maher (1981), Nurnburg (1977), Reckers and Stagliano (1977) and Vatter (1963) have noted that accounting concepts are vague and ambiguous because of their imprecise meanings. It is clear from this that vagueness and ambiguity are terms that describe a phenomenon that is unclear and has multiple meanings. Black (1963) argues that ambiguity exists when a word or concept has multiple meanings, while vagueness exists when the word or concept lacks precise shape and boundaries. Both terms imply the imprecision and inexactness of meanings of definitions and concepts. It follows that, in the accounting discipline, the meanings and descriptions of accounting phenomena are relative to a specific frame of reference. The meanings of accounting concepts, definitions and phenomena are thus dependent on the intuition and perception of the accountant.

According to Hornby (2005:1079), perception refers to the idea, belief or image that one has as a result of how one sees or understands something. Perception is relative to an individual. It is clear that there is no standard perception of reality. Consequently, different individuals will hold many views about reality. In chapter 2 it was noted that the meaningfulness of a measurement is dependent on the position taken by the measurer. The meaningfulness of a measurement is therefore dependent on the intuition of the measurer. In the accounting discipline

it is believed that the concept of measurement is dependent on the perception of an accountant and his social setting (Flanders, 1961; Ijiri, 1975). It follows that the perception of the accountant plays a fundamental role in the construction of accounting measurements. Gouws and Rehwinkel (2004:82) put it as follows:

By acknowledging the concept of contingency, it is virtually impossible to make verified empirical propositions about systems, since, given different circumstances, both systems and propositions are prone to adaptation. This contingent element is also transferred to the accounting system, confirming that it could never fall in the realm of pure classical science, being founded upon pure classical accountancy theory.

This quotation points to the opinion that accounting is not a natural science. It follows that accounting values cannot be accorded the same objectivity or empirical testability as can natural phenomena. The excerpt also highlights the fact that the accounting concept of measurement is dependent on the intuition of the accountant. It should also be noted that in representational measurement every pair of the representation and uniqueness theorems involves a choice of numerical relational structure (Luce *et al.*, 1971:12). These researchers argue that this choice of a numerical relation structure is essentially a matter of convention, and that conventions are strongly affected by considerations of computational convenience. It is clear, then, that the choice of a numerical relational structure onto which accounting phenomena can be mapped depends on how well the accountant can construct scales of measurement that can map the empirical relational structures of accounting phenomena onto the numerical relational structure. Unless the intuitions of different accountants are identical, it is unlikely that different accountants would make an identical choice of numerical relational structure for an identical pair of representation and uniqueness theorems.

The perception of a measuring accountant is also influenced by the entity concept. Staubus (1985), in his attempt to find a theory of accounting measurement, points out that the “entity “ concept is a theory which suggests

that accounting activities are specific to an entity. This means that the accounting entity is generally viewed as an economic unit under one management. The scope of the management's power determines, in a general way, the boundaries of the entity. Staubus (1985) also points out that this may be one of the reasons there is no simple statement that describes accounting measurement in a general way. It can also be inferred that the intuition of the accountant is influenced by the scope of management's power. It also follows that the judgements of the accountant with regard to accounting measurement are determined by the power of the management. The measurement perception of the accountant is thus strongly influenced by the perception of management.

Michell (1995:245) claims that the representational theory equates measurement with numerical coding (albeit a complex variety where relations are numerically coded along with attributes). This suggests that representational measurement is equated to a coded message. According to Hornby (2005:274), a coded message or coded information is written or sent using a system of words, letters or numbers that are understood by only a few people. Only persons who are familiar with the code used in constructing the message will understand it. This means that representational measurements will only be understood by persons who are familiar with their construction. If accounting measurements are relative to a specific entity, these measurements will also be coded relative to a specific entity. Consequently, the concept of accounting measurement is dependent on the entity concept. It can be further inferred from this that current accounting measurements are not comparable beyond the boundaries of a specific accounting entity.

Flanders (1961) argues that accounting measurements are dependent on the judgments of the accountant. It is clear from this that the concept of accounting measurement is also dependent on the judgment of the accountant. If this concept of measurement is dependent on the intuition of the accountant the selection of the attributes of accounting phenomena that are of use and interest to measure, their empirical identities and the empirical testability of the attributes will also be

dependent on the intuition of the accountant. Since from the entity concept perspective, the intuition of the accountant is dependent on the management of a particular entity, it would follow too that the empirical identities of the attributes of accounting phenomena that are of use and interest to measure are also dependent on the operating environment set by the management of a specific entity.

7.3 The objectivity of cost and value in accounting

This section discusses the objectivity of the objects of measurement in accounting. The IASB (2006) identifies cost and value as the phenomena in accounting which must be measured for the recognition of an item that meets the definition of an element of financial statements. It was noted in chapter 2 that the principles of measurement that are applicable to the accounting discipline are those of the representational theory of measurement. If cost and value are the objects of measurement, then, for accounting measurement to occur, these qualities of cost and value must be in harmony with the principles of the representational theory of measurement.

The IASB (2006: Para 83) framework for financial reporting states the following about cost and value:

“An item that meets the definition of an element should be recognized if:

- It is probable that any future economic benefits associated with the item will flow to or from the entity; and
- The item has a cost or value that can be measured with reliability. “

This definition indicates that proof of expected future economic benefits is necessary for the recognition in the financial statement of an item that meets the definition of an element of the financial statement. The definition also implies that the measurement of the attributes of future economic benefits is not a necessary condition for the recognition of an item that meets the definition of an element. It is only the expectations of future economic benefits that will flow from the item that should be measured. The object of measurement in accounting is cost or

value. This excerpt provides a choice to accountants. Accountants can choose whether to measure cost or value and they will still achieve the same results; that is, accountants can still achieve the recognition of an element of the financial statement in the financial statement. It can be inferred that cost and value can substitute each other: the properties of cost and the properties of value are similar and consequently one can be used to substitute another.

However, Littleton (1929) makes the point that cost and value are unrelated. He argues that cost furnishes the limiting factor to prices while value is subjective. This indicates that cost determines how high or how low the price of commodities should be, while value cannot be defined precisely. It is evident from this that there is confusion in the accounting discipline about the nature of cost and value and how they should be defined.

Furthermore, it should be pointed out that the current concept in accounting of cost and value is not in harmony with the principles of the representational theory of measurement. Consequently, cost and value are not currently measurable. An analysis of the definition of cost provided below indicates this. IAS 38 (2006, Para 8) defines cost as follows:

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

Cost is the numerosity of cash or the numerosity of cash equivalents paid or the numerosity of the units of fair value of other consideration given to acquire an asset. Cost is used as the value of the measurement function. Yet, earlier in this section (IASB, 2006 Para 83), cost was referred to as the object of measurement in accounting, and as the domain of the measurement function. This indicates that the accounting discipline has not fully recognized the distinction between the preformed theoretical constructs of the empirical relational system, the measurement function and the value of the measurement function. It is clear that the nature of cost cannot be objectively determined in accounting. In chapter 2 it

was noted that it is only objective phenomena that are measurable. Consequently, it follows that cost is not measurable.

It is also not known exactly what the amount of monetary units represents in accounting (see, Willet, 1987). It is evident from this that cost can be neither the value of a measurement function nor a measurable attribute. The value of a measurement function is supposed to represent the properties of the domain of the measurement function. But, in the case of monetary units in accounting, it is not known exactly what they represent and as a result monetary units cannot be known as a value of the measurement function.

It should also be noted that the concept of value is a subjective concept, and as a result value cannot be measured. Stamp (1981:23) makes the following remark about value and income:

Value and income, unlike mass and length, are not unambiguous and intrinsic properties of an accounting entity. Whereas all physicists agree on what they mean by “length” there is no general agreement among accountants on the meaning or relevance of “value” or “income”.

According to this, value cannot be empirically tested. Value does not have characteristics that are identical to those of natural phenomena. The concept of value has also been identified in this excerpt as a subjective concept on which accountants cannot agree. It is clear then that the concept of value that is the basis of accounting measurement cannot be determined with absolute certainty. Zebda (1991) adds that an ambiguous concept is unclear, unstructured and has multiple meanings. Consequently, the concept of value is unstructured, unclear and has multiple meanings. It should be kept in mind that measurement presupposes something to be measured and, unless we know what that something is, no measurement can have any significance (Caws, 1959). Consequently, if value is an ambiguous concept as outlined in the

extract above, then current accounting measurements of value cannot have any significance at all.

Moreover, Decoene et al. (1995) contend that 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 cannot be determined objectively and therefore it not possible to have measurements of value that satisfy the principles of the representational theory of measurement. As a result, accounting value or cost is not currently measurable in accounting.

7.4 The objectivity of the qualitative structures of accounting phenomena

This section discusses the objectivity of the qualitative structures (see chapter 2) of accounting phenomena. In chapter 2 it was noted that, in a measurement space, a precise definition of the empirical relational structure is necessary. Luce *et al.* (1971:12) assert that the empirical relational structure and its empirical properties should be invariant. This suggests that a qualitative structure and its properties should be objectively determinable. It follows that the properties of the empirical relational structure that is the subject of measurement should be empirically testable.

Luce *et al.* (1990) argue that a set of axioms leading to the representation and uniqueness theorems of fundamental measurement may be regarded as a set of qualitative empirical laws. The empirical relational structure and its properties should have an objective denotation. It is important to note that, in this case, something that is invariant is not necessarily a physical law. In the case of statistical analyses of measurements, the result should exhibit invariance appropriate to the structure underlying the measurements (Luce and Suppes, 2001). It follows that the numerical relational should be objective relative to the empirical relational structure it is representing. That is, the numerical relational

structure should exhibit the properties of the empirical relational structure. In other words, it should be possible to deduce the empirical relational structure from the numerical relational structure.

However, the evidence in the accounting literature suggests that accounting phenomena do not have qualitative structures (see chapter 2) that are objective relative to the abstract structure used to represent them. Value (see IASB, 2006) is currently regarded as the phenomenon the properties of which the accounting discipline currently aspires to measure. It is clear that the qualitative structure of value should be objective. Vickrey (1970) contends that there is no agreement relating to the amount of monetary units paid to acquire a commodity and its value. It is evident that in statistical analysis monetary units cannot be considered to be invariant relative to the underlying value of an accounting phenomenon. Furthermore, as Willet (1987) points out, it is not known with certainty what the monetary units represent in accounting. The underlying structure that monetary units represent cannot be precisely specified. It follows that monetary units cannot be considered to be objective relative to an unknown phenomenon the properties of which they purport to be measuring. Consequently, the qualitative structure of value cannot be considered to be objective.

Stevens (1951) asserts that a measure is a scaled-down value of the phenomenon itself. It is clear that there must be a precisely defined and clear, empirically testable relationship between the measure and the phenomenon that is being represented by the measure. Since, as has been pointed out (Ryan et al., 2002), it is not known what the monetary units represent in accounting, it can be inferred that the amount of monetary units paid to acquire a commodity is a presumed effect or correlate bearing an unknown relation to the value of the commodity. The amount of monetary units paid to acquire a commodity can only become a measure of value once the quantitative relation between the amount of monetary units and the value of a commodity is known. That is, monetary units can only become a measure of value when they are a scaled-down value of the units of the value of a commodity.

It has also been noted that some accounting phenomena do not have legitimate properties that can be empirically verified. Gouws and Van der Poll (2004) point out that some accounting transactions are based on simulated reality. This means that these transactions are not real, but a creation of the mind. Such transactions are dependent on the opinion of the accountant and they do not represent reality. 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 assertion highlights the point that measurement is only possible with objectively existing entities. Thus, numerical representations of simulated reality in accounting cannot be considered to be objective. This justifies the conclusion that the qualitative structures of simulated accounting reality are not objective as required by the principles of representational measurement.

The nature of the accounting discipline is such that the characteristics of accounting phenomena cannot be given a common empirical identity. Gouws and Rehwinkel (2004) believe that accounting is an art. They argue that art is not necessarily concerned with presenting an accurate portrayal of an object, but, in fact, different representations of the same object are not only acceptable but also desirable. These arguments suggest that, because accounting is an art, it is acceptable in the accounting discipline to have varying views about identical accounting phenomena. Varying descriptions of the qualitative structures of accounting phenomena are encouraged in the accounting discipline.

Tinker (1985:106) believes that accounting is a social artifact. This suggests that different social settings may use the principles differently. It can also be inferred that different social settings may produce different accounting measurements. Goldberg (2001) contends that each unit of experience has a unique experience of reality. There might be as many descriptions of accounting phenomena as there are units of experience. There may be as many measurement methods as there are units of experience. Mitchell (1995) makes the point that the

representational theory equates measurement with numerical coding (albeit a complex variety where relations are numerically coded along with attributes). A code is a system of communication that is specific to a particular group of people. If, as outlined earlier, accounting is an art, different ways of measuring the attributes of accounting phenomena are acceptable in the accounting discipline. Hence, in order to compare such varying ways of measuring the same attribute, it is necessary to convert them to a standard form of measurement.

Sorter (1969), Johnson (1970), Cushing (1989) and Goldberg (2001) all point out that accounting transactions that are based on predicted or foreseen happenings are not real. They argue that such transactions are classified as book entries as they do not represent reality. Predicted happenings are not reality, as they have not yet happened. Therefore the attributes of book entries cannot be determined objectively as they have not yet happened. Decoene *et al.* (1995) assert that it is only the attributes of objectively existing entities that are measurable. In other words, objects that do not exist do not have measurable attributes. In the same way, predicted happenings do not have measurable attributes, as they do not exist. Therefore, the possibility of accounting measurement is limited to only those transactions that represent reality.

7.5 The concept of measurement in accounting and the concept of public objectivity

The concept of objectivity in accounting measurement can also be investigated from the perspective of public objectivity. Public objectivity means being valid to the general public. According to Heelan (1965:82), the concept of public objectivity is based upon the presence of pure synthetic *a priori* features in the subject's knowledge of an object. Thus, the features that describe a public object should be the same for all observers in the same community of discussion. Brown (2000) also points out that such features are the axioms of intuition, the anticipations of experience, the analogies of experience and the postulates of empirical thought in general. The features that are used to identify an object as a public object should result from true identical statements from the intuition of the

observers. Consequently the thinking of the observers in the same community of discussion about the object should be identical. Hence it can be concluded that the experiences of the observers in the same community of discussion as the object should be identical and should be empirically verifiable.

There are two kinds of public objectivity. One belongs to an idea (or concept), and the other to a reality in its world (Heelan, 1965). The implications of these two kinds of objectivity for the concept of measurement in accounting are discussed in this section. It was noted in chapter 2 that measurement is applicable only to objectively existing phenomena. Consequently, the focus of the paragraphs that follow is on determining whether accounting phenomena exhibit either public objectivity of a reality or public objectivity of a concept (idea), or both.

Heelan (1965) argues that the objectivity of an idea or concept is that property which is possessed by an exact and precise definition. The definition of the idea or concept should be independent of particular places, times and factual occurrences. It does not belong to the world of the real but to the realm of ideas. The concept of public objectivity of a concept exists in the accounting discipline. The existence of this kind of objectivity is reflected in accounting definitions. For example, Vorster *et al.* (2008:14) define a liability as follows:

A liability of an entity:

- Is a present obligation;
- arises from past events;
- is the settlement which is expected to result in an outflow of resources embodying economic benefits from the entity.

This definition indicates that before a liability can be classified as such, a present obligation must exist. The obligation to part with resources must exist currently. It follows that before a liability can be classified as a liability, it has to be shown that the obligation exists currently. Furthermore, the definition makes clear that the obligation must have arisen from past events. It is evident from this that the occurrence of a past event that gave rise to the liability must be proved before a

liability can exist. Moreover, the settlement of the obligation must be expected to result in an outflow of resources from the entity. Before an obligation can be classified as a liability, evidence must be provided to support an expected outflow of resources at a future date as a result of the obligation. It is clear from this that a demonstration of the three aspects mentioned above is necessary for the existence of a liability irrespective of the location of the accountant. It can therefore be argued that a liability has an exact and precise definition that is independent of particular places and factual occurrences. That is to say, every accountant has to be familiar with the same concept of a liability, irrespective of his or her opinion and location. It can therefore be concluded that the definition of a liability exhibits the public objectivity of an idea (concept).

On the other hand, it can also be argued that the concept of a liability is an ambiguous concept. From the definition above, it is evident that there is no clear specification of a present obligation, or a clear specification of which past events give rise to a liability. Nor is there a clear definition of an expected future outflow of resources embodying economic benefits from the entity. This indicates that different individuals may attach different meanings to the definition of a liability. It can be argued that the definition of a liability involves ambiguity because of the imprecise meaning of its phrasing.

Zebda (1991:119) also reveals that ambiguity exists in many accounting concepts when he notes the following phrases: “the financial statements present fairly the financial position of the firm”, “the internal control system is strong or weak”, “if there are material weaknesses in the internal control, expand sample size”, “investigate large or significant variances”, “allocate overhead costs by using fair bases”, and “joint products are classified as by-products if they have a small sale value.”

The use of phrases such as “present fairly”, “strong or weak”, “material weaknesses”, “large or significant variances”, “fair bases”, and “small sale value”, imply that accounting concepts have multiple meanings. These words could mean different things to different people. For instance, what is fair for one individual

might be unfair for another, and what is large or significant, material or small for one could have a completely different meaning for another. Zadeh (1965) argues that ambiguity and vagueness deal with classes of objects with no sharp or exact boundaries between what is and what is not. Consequently, if these statements are to be considered unambiguous, it is necessary to have a sharp or precise meaning of what they mean. It can therefore be concluded that there is evidence in the accounting discipline that accounting concepts do not exhibit the public objectivity of an idea or concept.

According to Peacocke (1996), the objectivity of a reality in its world belongs to a shared world of real things. It can be inferred from this that a reality in its world should be capable of being viewed or experienced by all the observers in the same community of discussion. A reality in its world is also part of other realities in that particular world. It participates in forming that particular world. Moreover, Heelan (1965:81) states that “it is the object of factual judgments, founded upon perception and – unlike the precision of an idea – it is accompanied by an irreducible element of impreciseness and indeterminateness”.

This quotation stresses that the identity of a public object is also dependent on what the observer sees and makes of the object. The use of the phrase “it is the object of factual judgments, founded upon perception” implies that a public object is a reality that is known to exist in a particular world whose characteristics depend on the perception of the observer. This means that the empirical properties that are used to identify a public object are dependent on the observer. For observers to agree on the empirical properties of a public object, there has to be a convention that determines what constitutes the empirical features of a public object and what does not. A public object is accompanied by an irreducible element of impreciseness and indeterminateness. It is evident from this that there is no precise way of describing how one sees an object. There is no precise way of determining a public object. It follows that each observer has a personal and subjective view of the object, although the object is real. Therefore, it can be

concluded that public objectivity is universal in a well-defined domain. That is, it is socially constructed.

The concept of public objectivity of a reality in its world is implied in current accounting practice. The IASB framework (2006) for financial reporting points out that users must be able to compare the financial statements of different entities in order to evaluate their relative financial position, performance and changes in financial position. It is expected in the accounting discipline that accounting measurements be common across different companies. That is, users should be capable of interpreting measurements from different companies in the same way. Therefore, there must be an agreement that determines the production of accounting measurements by accountants and the interpretation of financial statements by users. This agreement must specify exactly what it is that accountants measure and how the users of financial statements should interpret measurements. Consequently, it makes sense to assume that if financial statements are to be comparable, accounting phenomena must have the property that makes them valid for general users of financial statements.

It should be noted, however, that accounting measurements do not exhibit public objectivity of a reality in its world. This is because the property that is currently being measured in accounting does not have the qualities that allow it to exhibit public objectivity of a reality in its world. Value or cost is currently the object of measurement in accounting (IASB, 2006). According to the IASB framework (2006) for financial reporting, an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured reliably. In section 7.3 it was established that cost and value are not measurable, as they are subjective and do not have a precise definition or an objective existence. This means that value or cost do not have the characteristics that can make them publicly objective. Ryan *et al.* (2002) also point out that value does not have characteristics that can be empirically tested. They argue that there is no general agreement among accountants on the meaning or relevance of value. This means that the concept of value does not have the exact and precise

definition that is necessary for a phenomenon to exhibit public objectivity. It follows that value and cost are not objects of factual judgments. Therefore, it can be concluded that value and cost are not physical objects and cannot be observed directly.

7.6 The accounting concept of measurement and the concept of empirical objectivity

The concept of objectivity in accounting measurement can also be investigated from the perspective of empirical objectivity. The concept of empirical objectivity refers to the objectivity that is based upon the exteriority of subject and object (Heelan, 1965:82). This viewpoint suggests that objectivity can be established if the subject and the object are two distinct entities. The object of experience must be separate from the observer in order for it to be experienced. It follows that the concept of empirical objectivity is based on the viewpoint that knowledge is uniquely determined by experience. Ryan *et al.* (2002:12) describe the concept of empiricism as follows:

Traditionally, classical empiricists accept that:

- Certainty of belief in what we know can only be approached through perception.
- Ultimately, all knowledge is derived from perception through our senses.
- In the realm of discourse, statements are either true or false because of the way the world is or because of some formal properties of the language we use.

This description points out that one can acquire knowledge about the world only through perception. According to Hornby (2005: 1078), perception refers to the way an individual notices things with the senses. An individual acquires knowledge about the world only through the senses. This explanation also points out that the truth of an individual's perceptions about the world can be judged against what the world really is or against the formal consensus in the world of

what the truth is. Beliefs about the world cannot be justified by reason alone, but should also be justified in terms of the experiences derived from the objects under study. It can be inferred from this explanation that the objects under study should possess space-time coordinates that are independent of the observer. That is, the objects being studied should occupy space that is separate from the observer at a particular point in time. This implies that the observer and the object have an existence that is independent of each other. Therefore, it can be concluded from this that the concept of empirical objectivity can only be exhibited by an entity that is a subject of physical properties that can be verified independently of the observer.

The concept of empirical objectivity is implied in the current accounting measurement literature. The IASB framework (2006) for financial reporting states that an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured with reliability. This implies that an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that is measurable. In chapter 2 it was pointed out that the concept of measurement is only applicable to empirical phenomena. Thus, for value to be measurable, it must have an existence that is independent of the accountant. Both value and the accountant must have an existence that is independent of each other. This justifies the conclusion that the accountant must have an empirical experience of value or cost through his senses in order to be able to measure cost or value.

The claim that accounting measurements are empirically objective is unfounded, however. This is because value and cost, the properties that are subject to measurement in accounting, are not empirically objective. In Chapter 6, section 6.2 it was noted that value is an ambiguous concept that is variant. This suggests that value cannot occupy space at a specific point in time. Moreover, value cannot be located in space at a specific point in time independently of the accountant. Value does not lie outside the observer's mind, but occupies the same space as the observer. In section 7.4 it was noted that cost is currently referred to as both

the domain of a measurement function and the value of that measurement function. This indicates that cost does not have sharp or distinct boundaries. As was stated in section 7.5 (Zadeh, 1965), concepts that do not have sharp or distinct boundaries are vague and ambiguous. This suggests that cost and value are vague and ambiguous. It can thus be concluded that both cost and value are ambiguous concepts that are not invariant, and which cannot be empirically objective.

7.7 The accounting concept of measurement and the concept of formal objectivity

In this section the concept of formal objectivity in accounting is discussed. This concept is implied in the accounting discipline in some instances, while in others it is not. Its absence is particularly notable in accounting quantifications, while its presence is noted in some accounting definitions. According to Heelan (1965:83), formal objectivity is an objectivity that is constituted by an affirmation, which releases an object from dependence on a knowing subject. The use of the word “affirmation” means that there is an express agreement in the objective world of the observer about the knowledge the observer has of the object. The subject’s knowledge about the object is not determined by perception and appearance but through express agreement. This implies that the interaction between the subject and the object in their world is predetermined. It can be concluded that the community or the societies in which the object and the subject resides determine the interaction between the subject and the object.

Sayre (1976) asserts that formal logic is the employment of artificially formulated symbols and arbitrarily defined relationships to provide the norms by which reasoning is regulated. This indicates that in formal logic there has to be an agreement on what can be described as the interaction between the subject and the object. It follows that formal logic prevents the proliferation, in a community, of what can be considered as the interaction between the subject and the object. Consequently, the subject attributes characteristics to the object not as a result of

his experiences with the object but of what the community decides should be the nature of the interaction.

Formal objectivity in the accounting discipline is evidenced by the definition of the elements of financial statements. The definition of an asset is constituted by an affirmation that releases it from dependence on a knowing subject. The IASB framework (2006: Para 49) for financial reporting defines an asset as: “An asset is a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity.”

An economic resource must have three characteristics prior to being considered an asset. That is, the resource should provide future economic benefits, these benefits should be within the control of the enterprise, and the event giving rise to the company’s right to the resource and control over future benefits must already have occurred (i.e., a past event). It can be inferred from this that the objectivity of the definition of an asset belongs to whatever is affirmed as a virtually unconditioned definition of an asset on the basis of the evidence outlined. Therefore, in order to determine whether an event in an accounting world is an asset, a process of testing and verification must be carried out to confirm the presence of evidence confirming the definition of this asset. The existence of the definition of an asset is not dependent on the subjective view of the observer, but its existence (asset) is absolute and unquestionable. The evidence that is used to test the existence of the definition of an asset is standard. It is not dependent on the circumstances of the observer. Public understanding, use and definition of an asset do not define the formal objectivity of an asset. It exists even without the knowledge of the public.

Strict evidence of the three characteristics mentioned above (IASB, 2006: Para 49) is required before an entity can classify an economic resource as an asset. Thus, an asset is an unconditioned object, and an object in the strict or formal sense. Its intention is simply to express what is (asset), independently of the act whereby I know it as an object (asset) for me. Therefore, it can be concluded that

in formal objectivity the concept of an asset is independent of the opinion of the observer.

However, the recognition of the elements of financial statements implies the non-existence of formal objects in accounting. For example, Vorster et al. (2008:17) state:

To be recognized as an element in financial statements:

- An item must meet the definition of one of the elements of the financial statement;
- It should be probable that future benefits associated with the item will flow to or from the entity; and;
- It must have a cost or value that can be measured reliably.

The above indicates that an element of financial statements should be recognized in the financial statements if an entity expects future economic benefits to flow from the element. An element of financial statements should be recognized if it has a cost or value that can be measured with reliability. It is evident from this that for an element of financial statements to be recognized, it must possess the characteristics specified above. However, in spite of the accounting discipline agreeing on the probability of future economic benefits flowing to the enterprise as a condition for recognizing an asset, there is no specification of the empirical identity of future economic benefits. Furthermore, since the future has not yet happened, its identity cannot be reliably specified. Thus, it is not possible to measure something that is based on expectation reliably. It is only the expectation of the phenomenon that can be reliably measured.

In section 7.4 it was mentioned that value is an ambiguous concept that is not invariant. This indicates that the characteristics of value vary with the opinion of the accountant. Consequently, accountants cannot agree on the characteristics of value. It should be pointed out that it is not possible to measure an ambiguous phenomenon. According to Stevens (1951), measurement is only possible with

empirical phenomena. This means that it is not possible to measure non-existent phenomena. It is therefore not possible to measure empirically characteristics of non-existent phenomena, as they cannot be specified. Each individual has his or her own opinion about the measurable characteristics of an asset. Therefore, it follows that the recognition criteria of an element of financial statements are not formally objective.

7.8 Summary and Conclusions

The concept of objectivity is fundamental to measurement. Its absence from a discipline is a clear demonstration that the discipline is not a measurement discipline. Accounting is regarded as a measurement discipline. All measurements should be objective. As a result, one would expect accounting practices of measurement to be objective. However, this chapter has found that current accounting measurement practices are not objective. This suggests that the current practices should not be referred to as practices of measurement. Furthermore, this casts doubt on the status of accounting as a measurement discipline. A recap of the conclusions drawn from this chapter indicate the following:

- The accounting discipline asserts that accounting measures are objective. Yet, accounting measurements are measurements by fiat. Consequently, they depend on the intuition of the experimenter. Therefore, the accounting discipline tends to encourage subjective accounting measurement practices assuming that they will be unbiased.
- In this chapter it was argued that some accounting definitions exhibit the public objectivity of a concept. The accounting definition of a liability is exact and precise and belongs to the realm of ideas. It has been noted in this chapter that accounting phenomena are not publicly objective. Furthermore, current accounting measurement practices are not publicly objective. It is evident that this prevents accounting values from being

objective beyond the borders of an accounting entity. As a result, accounting measures are not comparable.

- Accounting phenomena are not empirically objective. Furthermore, accounting measurement practices are not empirically objective. It follows that an individual's experience of accounting measurement is unique. Consequently, an individual's interpretation of experience may vary according to changes in the state of his health, state of mind, and the kind of experience he is undergoing at the time. Therefore, one can see that the objectivity of current accounting measurements varies with the intuition of the accountant. In addition, the attributes of accounting phenomena are not specified in the accounting literature and as a result their empirical objectivity cannot be determined.
- The definitions of accounting phenomena are formally objective. But the attributes of accounting phenomena that are of use and interest to measure are not formally objective. Thus the current accounting measurement practices are not formally objective.

The discussion in this chapter has indicated that accounting phenomena are not objective. In chapter 2 it was noted that all measurable phenomena must be objective. Consequently, this means that accounting phenomena are not measurable.

Chapter 8- Representational measurement and the concept of relativism in accounting

“Measures are more than a creation of society, they create society” (Alder, 2004:342)

8.1 Introduction

In this chapter the relative nature of accounting measurements is discussed. According to Ryan *et al.* (2002), relativism is a term given to a group of ideas which argue that truth is relative to the beliefs of the observer. They argue that all belief is relative to the social value system and norms that transcend the individual level. This suggests that the beliefs of an individual are influenced by his environment and are a reflection of his or her learned experiences in this environment. It follows that before the beliefs of individuals from different frames of reference can be compared, they must be converted to a common frame of reference.

Measurement is considered to be a relative concept: according to Stevens (1951), measurement is relative in nature. He argues that measurement varies in kind and degree, in type and precision. All measurements are relative to a specific frame of reference. Luce *et al.* (1971) argue that the choice of a numerical relational structure for a particular empirical relational structure is a matter of convention. It is clear that measurements vary with respect to their frames of reference. Consequently, measurements from different frames of reference must be converted to a common frame of reference before they can be compared.

According to Mattessich (1964:79), accounting measurements are dependent on the intuition of the accountant. This suggests that accounting measurements are dependent on the opinion of the accountant. It follows that accounting measurements made by different accountants cannot be compared unless their different opinions are converted to a common frame of reference. However,

Chambers (1997) notes that the conditions under which different accounting measurements are made are not stated in the accounting literature. He argues that the lack of specified conditions under which measurements have been made leads to the comparison of measurements being made under non-standard conditions. This suggests that the accounting concept of measurement does not take into account the relative nature of accounting measurements.

In chapter 1 it was noted that accounting measurements are dependent on the opinion of the accountant. Thus, it follows that accounting measurements are relative to the opinion of the accountant. The purpose of this chapter is to investigate the implications of this concept of relativism in accounting measurement. The effects of the factors that cause relativism on the accounting concept of measurement will be discussed.

The structure of this chapter is as follows: a discussion of the implications of different frames of reference in accounting on representational measurement occurs in section 8.2 and a brief discussion of the implications of the concept of relativism on accounting measurement is presented in section 8.3. In section 8.4 a brief account of the sources of relativism in accounting measurement is given, followed by a discussion of the implications of cognitive relativism in accounting in section 8.4.1. The implications of cultural relativism are discussed in section 8.4.2. The chapter also covers the implications of the concept of linguistic relativism on accounting measurement in section 8.4.3 and the implications of contractual relativism on accounting measurement in section 8.4.4. The conclusion is presented in section 8.5.

8.2 Framing and representational measurement in accounting

In chapter 2 it was noted that the concept of representational measurement should be viewed with reference to a specific social context. This means that representational measurements are relative to a specific frame of reference. Stevens (1951) believes that the configurations of the immediate environment

affect the choice of variables to be measured as well as the measurement procedures. This suggests that the intuition of the individual who is measuring is affected by the configuration of his immediate environment. In the accounting discipline, the accountant conducts measurement. According to Mattessich (1964), accounting measurements are dependent on the opinion of the accountant. The intuition of the accountant is determined by his or her social situation. Goffman (1974) points out that social situations are subject to ordering by frames which establish the meaning of events and regulate the activities of participants. It is clear from this that the social setting determines how the empirical relational structures of accounting phenomena are represented by abstract structures. Similarly, Sayre (1976) argues that shared conceptual structures provide the basis of cultural identity and information for the guidance of individual behaviour in situations recurring within the cultural group. Individuals under the same conceptual structures share the same culture, thought process and behaviour. This suggests that the thought processes of accountants are determined by the conceptual structures under which they operate. Likewise, the judgments of accountants will be determined by the conceptual structures under which they operate.

Luce *et al.* (1971) point out that every pair of the representation and uniqueness theorems involves a choice of a numerical relational structure. They argue that this choice is essentially a matter of convention, although conventions are strongly affected by the considerations of computational convenience. This viewpoint suggests that the choice of a numerical relational structure is arbitrary. It follows that the context of computational convenience is determined by the social structures of the individual who is measuring. It can be inferred from this that the representation of an empirical relational structure by a numerical structure is a matter of conventions made in a social context. Consequently, representational measurements should be evaluated relative to their social contexts before they are used.

8.3 The concept of relativism in accounting measurement

The definition of the context in which information is objective is governed by the concept of relativism. Relativism is a term given to a group of ideas which argue that truth is relative to the beliefs of the observer (Ryan *et al.*, 2002:16). In other words, beliefs of individuals are socially constructed. The idea of relativism is coherent only if one can make sense of the idea that different points of view have no common coordinate system on which they can be plotted (Sosa and Villanueva, 2002). If differences of conceptual schemes always have such a common underlying coordinate system, this will undermine the point of seeing them as different and, in turn, undermine the very idea of a conceptual scheme. Since Stevens (1951) indicates that measurements are relative to a specific frame of reference, it follows that seeing measurements from different frames of reference as identical would undermine the whole point of seeing them as being from different frames of reference. Mattessich (1964) considers accounting measurements to be relative to the opinion of the accountant. This implies that accounting measurements have to vary in accordance with the opinion of the accountant; if they did not vary it would undermine the whole viewpoint of seeing them as dependent on the opinion of the accountant.

Accounting is considered a social science, and the representational theory of measurement that is applicable to social sciences produces measurements that are considered to be relative. Accounting measurements should thus also be seen as relative. Michell (1995:245) describes the relative nature of representational measurement as follows:

The representational theory of measurement equates measurement with numerical coding (albeit a complex variety where relations are numerically coded along with attributes), while the realist theory equates measurement with the discovery of empirical facts of a numerical kind. Numerical coding always involves a conventional component: the agreement to code certain empirical attributes with certain numbers, and certain empirical relations

with certain numerical ones. It is this component that is captured by the representation's uniqueness theorem.

This description points out that representational measurements are numerical codes. The term "coded" used in this context implies that representational measurements use a system of numbers or symbols to represent empirical phenomena that can only be understood by a specific group of individuals. Individuals who are not part of this specific group are unable to understand representational measurements. It can also be inferred from the above quotation that the choice of a numerical structure to represent an empirical relational structure is a matter of convention. It would follow logically that the choice of accounting empirical relational structures should also be a matter of convention. The above quotation also indicates that the domain in which representational measurements can be evaluated should be specified. Furthermore, proving the uniqueness theorem on a numerical representation of an empirical relational structure is also a matter of convention. Since accounting measurements are expected to be representational measurements, they should also have a conventional component, that is, the existence of an agreement among a group of people to measure particular accounting phenomena in a particular way.

Accounting literature also points towards the viewpoint that current accounting measurement practices should be evaluated with respect to a specific frame of reference. Mattessich (1964:79) states that most of the economic and accounting measures belong in the category of measurement by fiat, which is reflected in a certain definitional arbitrariness of the discipline. This point of view holds that measurement statements about accounting phenomena are highly dependent on the intuition of the accountant and should therefore be evaluated with respect to a specific frame of reference. In other words, the factors that influence an accountant should be taken into account when evaluating accounting measurements.

Tinker (1985:81) highlights the notion that accounting practice is a means of resolving social conflict. He argues that it is a device for appraising the terms of exchange between social constituencies, and an institutional mechanism for arbitrating, evaluating and adjudicating social choices. In this view, accounting was designed to describe relationships that are governed by social situations. Accounting information is seen as a reflection of a specific social situation. If accounting is a device for appraising the terms of exchange, then accounting information in financial statements reflects an appraisal of a specific system of social exchange. It follows that different financial statements reflect different systems of social exchange. Therefore, information in financial statements should be interpreted relative to the social environment that has produced it.

The nature of the accounting discipline also suggests that accounting measurements are relative to a specific frame of reference. Accounting is considered to be an art (Gouws and Rehwinkel, 2004). Gouws and Rehwinkel (2004) argue that different representations of the same object are not only acceptable but also desirable. Consequently, it can be argued that it is not possible for different frames of reference to view the measurement of accounting phenomena in an identical manner. Each occurrence is unique and should be treated as such. As a result, different companies are likely to have different economic experiences and consequently, to describe economic events differently. This means that if accounting measures are to be considered objective across different communities of discussion, there must be a convention that guides the measurement of accounting phenomena. An agreement in a community of discussion on how to measure an identical accounting phenomenon ensures that measurements are comparable throughout the community of discussion.

However, the accounting discipline does not recognize the relative nature of accounting measurements. For example, the IASB framework (2006:39) for financial reporting points out that:

Users must be able to compare the financial statements of a company through time in order to identify trends in its financial position and performance, and to compare 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 effects 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.

This point indicates that accounting measurements can be compared across different time intervals and across different entities. It stresses that the attributes of accounting phenomena must be measured in a consistent way over time and across entities. This suggests a belief in the accounting discipline that there are attributes of accounting phenomena that are common across different accounting entities and accounting periods that can be viewed and measured in the same way. However, there are no specified attributes of accounting information that are common across different accounting periods and across different companies. Chambers (1997) notes that attributes that are the subject of measurement in the accounting discipline are not specified, yet every measurement scheme requires the specification of a property that is being measured. Such a specification ensures that identical properties are compared across different entities. Therefore, either this property is so well known in the accounting discipline that it does not need specification, or the discipline is not complying with the principles of measurement. If accounting phenomena can be viewed in the same way from different frames of reference, accounting phenomena must be laws of nature. This is in direct contrast to accounting's classification as a social science. The characteristics of phenomena in social sciences are dependent on the opinion of the observer. It is therefore necessary to determine the specific identity of the phenomenon that is being measured.

8.4 Sources of relativism in accounting

Accounting measurements are socially relative. Tinker (1985:89) supports this when he states that value and accounting are socially relative. It can be inferred from this that the measurement of value in accounting is also socially relative. Accounting measurements must be evaluated according to their social context. Some causes of relativism in accounting are discussed in this study to illustrate how accounting measurements are dependent on the learned relations of an observer in his environment. Belkaoui (1990) identified four major sources of relativism in accounting, namely, cognitive relativism, cultural relativism, linguistic relativism and contractual relativism. These forms of relativism are discussed and applied in the sections that follow.

8.4.1 Representational measurement and cognitive relativism in accounting

In this section the concept of cognitive relativism is discussed. Mattessich (1964) believes that accounting measurements are dependent on the opinion of the accountant. This means that accounting measurements are dependent on the intuition of the accountant. It is thus clear that the concept of cognitive relativism is central to the nature and interpretation of accounting measurements. Cognition refers to the gaining of knowledge by thought and perception (Hawker, 2003:110), in other words, the process by which knowledge and understanding is developed in the mind. It follows that accounting measurements are dependent on how knowledge and understanding are formed in the mind of an accountant. Gouws and Rehwinkel (2004:82) emphasize the importance of cognition to the creation and interpretation of accounting measurements:

Accounting is often defined as an art. It is an artificial science consisting of knowledge about artificial objects and phenomena. Artificial refers to the non-natural.

This definition underscores the point that accounting values cannot be inferred through natural laws and should not be treated like natural phenomena. The definition also highlights the belief that accounting measurements are dependent on the opinion of the accountant. The use of the word “non-natural” implies that accounting attributes that are of use and interest to measure in accounting are not objects of physical experience. This leads to the belief that the empirical identities of the attributes that describe the empirical properties of accounting phenomena are dependent on the definitional arbitrariness (see, Mattessich, 1964) in the accounting discipline. As a result, the empirical significance and the meaningfulness of accounting measures are dependent on the intuition of the observer. Furthermore, if a particular definition is chosen then no conclusive argument need be invoked to defend this definition. In addition, the term “arbitrary” indicates that another definition could have been chosen instead. Therefore, a definition assigned to a phenomenon is dependent on the intuition of the accountant.

The concept of cognitive relativism draws particular attention to the context in which individuals perform accounting measurement practices. The individuals performing accounting measurement roles are members of particular organizations. These organizations would have established certain codes of behaviour in order to bring about a certain desired outcome in accounting measurement. As a result, organizational influence affects the cognition of an individual. Belkaoui, (1990:123) describes the situation as follows:

The organizational culture to which an individual belongs ultimately determines the judgment or decision process in accounting, by providing the experimenter with schemas of good and bad solutions that will increase the ability to determine how to operate in the organizational culture or clan.

The extract points out that accounting decisions made by an accountant are determined by the organizational culture. The organizational culture also determines the way an accountant responds to accounting problems in the

organization. Because accounting measurement is dependent on the intuition of the accountant (Mattessich, 1964:79), it can be inferred that the measurement abilities of an accountant are shaped by the organizational culture that accountant experiences.

Decoene *et al.* (1995) assert that the choice of an appropriate qualitative axiom system of a reality depends entirely on a deep understanding of that part of reality one is studying. They also argue that if the research domain is poorly understood, it is impossible to arrive at an explanation that suggests appropriate qualitative axioms. Consequently, it can be inferred that the above passage suggests that the selection of the attributes that are of use and interest to measure in the description of the empirical properties of accounting phenomenon is dependent on the culture of the organization. The empirical identity of the attributes that are of use and interest to measure is thus dependent on the culture of an entity. Therefore, before accounting information is compared to similar information from other companies or to similar information from past periods in the same company as required by IASB (2006), it is necessary to specify what is considered to be similar about the information. The specification of such attributes ensures that similar measurements are compared across different entities.

8.4.2 Representational measurement and cultural relativism in accounting

The influence of the culture of a business entity on accounting measurements is discussed in this section. In section 8.4.1, it was noted that the accounting decisions made by an accountant are determined by the culture of an organization. Put another way, the opinions of the accountant are shaped by the culture of the organization. According to Hornby (2005:357), culture is a way of life of a particular group of individuals. The customs and beliefs of a group of individuals reflect how they co-exist with the environment. Belkaoui (1990) point out that in any organization, the organizational activities reflect the way of life of

an organization. This means that organizational activities reflect the habits, attitudes and traditions that help people in that organization to co-exist. Simons, Vazquez and Harris (1993:142) are also very clear about the nature of culture:

It is developed and communicated by a group of people, consciously or unconsciously, to subsequent generations. It consists of ideas, habits, attitudes, customs, and traditions that help create standards for people to coexist. It makes a group of people unique.

This description points out that culture is developed by a group of people knowingly or unknowingly. The way people in a particular organization or society communicate reflects their culture. Since it was noted in section 8.4.1 that the intuition of the accountant is determined by the culture of an organization, this indicates that the way the accountant communicates accounting information reflects the culture of an organization. It follows, too, that accounting measurements made by an accountant reflect the culture of an organization. And that culture of an organization makes a group of people unique. If this is true, and measurement is part of culture, accounting measurement practices must be unique to a group of people or a business organization. It follows that accounting measurements should be interpreted with respect to a specific entity.

Tinker (1985:82) points out that accounting is part of the battery of belief-forming institutions, including the law, education, the media, religion, and the family. He argues that the exact function of any one belief-shaping institution, relative to others, may vary from one social context to the other. This indicates that accounting is part of these institutions that shape the beliefs of individuals in a social situation. The way accounting shapes these beliefs will depend on the nature of the social context. As has been pointed out above (Simons et al, 1993), each organization has its own unique culture, so it follows that the way accounting affects the beliefs of individuals in a specific organization is determined by their

culture. It can therefore be concluded that the production of financial statements is dependent on the culture of an organization.

According to Flamholtz (1983), organizational culture plays an important role in control systems design. He argues that control systems which are inconsistent with an organization's value system are likely to create resistance and to produce motivations aimed at defeating the purpose of the core control system. Prior attempts to create a theory of accounting measurement (e.g., Littleton, 1940; Littleton, 1953; Gilman, 1939; Staubus, 1985, 2004; Walker and Jones, 2003) that focused on the observation of accounting measurement practices from different business organizations implied that there are some common elements in the culture of different business entities. But the lack of success of these attempts to create a theory of accounting measurement suggests that there are no common points between the cultures of different business entities. As a result, it can be argued that accounting measurements cannot be common between different business organizations.

If culture creates a unique world, it can also be argued that each of these worlds represents some subject's sphere of reality. It follows that, in order to see it as such and to explore the richness of the reality revealed in its perspective and illuminated by its light, the universe of the facts of this reality should be defined. Furthermore, each culture creates taken-for-granted models of the world that are widely shared by members of their society and which are crucial in their understanding of that world and their behaviour in it (Belkaoui, 1990:121). Hence, one must be part of such a world in order to understand what is going on in that world. The failure to be part of such a world leaves individuals unable to draw appropriate conclusions about the true identity of such a world. This indicates that in order to understand accounting measurements one has to be part of the process of measuring: one has to be part of the culture of a business organization to understand accounting measurements produced by the business organization.

8.4.3 Representational measurement and the concept of linguistic relativism in accounting

Section 8.4.1 explained that an accountant's cognition with respect to accounting decisions is determined by the culture of a business organization. It was noted in section 8.4.2 that organizational culture is part of the communication process of the business organization. This suggests that culture forms part of the language of an organization. Culture varies from organization to organization (section 8.4.2). Therefore, if culture is part of the communication process of a business organization, the system of communication in business organizations will vary according to their culture.

According to Belkaoui (1990), accounting is a language. This suggests that accounting is used as a system of communication by business entities. If this is the case, it follows that accounting information varies with organizational culture. Goldberg (2001:70) describes communication as "the use of signs and symbols by which men influence each other". For communication to occur there is a need for common understanding between the people who are communicating. It follows from this that men can only influence each other through signs and symbols if all the parties communicating understand these signs and symbols. Goldberg (2001) argues that successful communication requires some commonness of experience between sender and receiver, and some agreement on the relationship between the signs or symbols to be used to refer to such experiences. For communication to occur, the parties communicating must be clear as to the meaning of the information. If, as outlined earlier (Belkaoui, 1990), accounting is a language, the failure of researchers in the field to develop a comprehensive and coherent theory of accounting measurement from the observation of accounting measurement practices (e.g., Gilman, 1939; Littleton, 1940; Littleton, 1953; Staubus, 1985) indicates that different organizations use different accounting languages to communicate. This underlines the point that accounting information is a language that is relative to a specific organization.

Goldberg (2001:70) contends that the process of communication comprises the functions of preparing, formulating or encoding a message, sending or transmitting it to another or others, and its reception by another who interprets or decodes it. This viewpoint indicates that communication is only possible if the parties communicating are familiar with the signs and symbols of communication. It can also be inferred that, if accounting is a language as outlined above (Belkaoui, 1990), then accounting information must be familiar among the parties communicating the accounting information.

Sayre (1976:222) highlights the dependence of language on social contexts when he states:

By means of a shared language, individuals with common needs and interests can influence each other in the formation of conceptual structures without each participating in the full range of trial and error experience necessary to assure an enduring conceptual network.

This points to the fact that a common language among individuals creates a mode of communication that does not require formal structures for its existence. Individuals to whom the language is common unconsciously understand the informal mode of communication that is established by the common language. If organizational culture is part of the communication process of a business as outlined in section 8.4.2 (Belkaoui, 1990) it can be inferred that individuals who are not part of an organization cannot be considered to share a common language with individuals who do participate in it. This means that users of accounting information and accountants must be part of the same organizational culture and must agree on what the information produced by an organization means and what it may be used for.

8.4.4 Representational measurement and the concept of contractual relativism in accounting

The concept of contractual relativism supports the view that accounting information is relative to a specific frame of reference. According to Belkaoui (1990:123), the concept of contractual relativism in accounting is a point of view which suggests that contracts define permissible behaviour and actions that ultimately determine the judgment/ decision process in accounting. The contract in this case is considered to be the determinant of the intuition of the accountant. In section 8.4.3 it was indicated that the culture of a business organization determines the accounting decisions made by an accountant. If this is the case it implies that contractual relationships define the culture of a business organization. Baiman (1990:341) explains the agency relationship as follows:

An agency relationship exists when one or more individuals (called principals) hire others (called agents) in order to delegate responsibilities to them. The rights and responsibilities of the principals and agents are specified in their mutually agreed upon employment relationship. Within the term employment relationship I include the chosen: compensation arrangement information systems, allocation of duties, and allocation of ownership rights.

This explanation points out that an agency relationship is specific and unique to a group of people: it is not universal. The interaction between the agent and the principal is also specified in the contract between them. This means that the agent's activities and judgments made in carrying out these activities are specified in the contract. If this is the case, each specific agency relationship will have its own specific rights and duties. As a result, the information needs of each principal are unique. Consequently, it is inappropriate to compare information from different agency relationships without adjusting for the differences in these relationships.

It is also important to note that accounting measurements produced under different agency relationships are not comparable. This is because such

measurements are not identical. This is reflected by the concept of value measurement in accounting. The IASB framework (2006) for financial reporting points out that an item that meets the definition of an element of financial statements should be recognized if the item has a cost or value that can be measured with reliability. This suggests that value can be independently verified. But, in fact, value measurement is relative to contractual agreement. Abdel-Magid (1979) notes that the amount of monetary units paid to acquire a commodity is a measure of its value. There is a relationship between monetary units and value that can be empirically verified. Yet, Ryan *et al.* (2002:118) also point out that there is no agreement relating the amount of monetary units paid to acquire a commodity and its value. This means that the nature of the relationship between monetary units and value is dependent on the interests of the parties to the transaction. If this is the case, the relationship between the amount of monetary units paid to acquire a commodity and its value is dependent on the contractual relationship between the agent and the principal.

The concept of contractual relativism has implications for the qualitative characteristics of financial statements. According to IFRS (2006), accounting information is useful if it is comparable to similar information from other companies or similar information from past periods from the same company. Therefore, accounting information is comparable between companies if the contractual relationship between the agents and the principals of these companies is the same. Accounting information from different accounting periods will also be comparable if there is no change in the contractual relationships between the agents and the principals during the periods being compared.

The qualitative characteristic of relevance is also affected by the concept of contractual relativism. According to Kirk (2005:7), information must be relevant, i.e. up to date and current, and actually used by the reader. But, if as outlined above (Baiman, 1990), the rights and responsibilities of the principals and agents are specified in the mutually agreed-upon employment relationship, it can be argued that the relevance of the accounting information that is produced by the

agents is dependent on the agreement in the contractual relationship between the agents and the principals. That is, the agent has to produce the information that the principal wants. In order to ensure that the agent complies with this requirement the principal must include this requirement in the contract. Consequently, the relevance of the information is dependent on the contractual relationship.

Kirk (2005:7) also points out that the concept of understandability insists that the information that is provided by the reporting entity should be presented in such a way that it is as understandable as possible to the user. However, since the responsibilities and duties of agents are defined by the contractual relationship between agent and principal, the understandability of accounting information is also defined by this contractual relationship. Tinker (1985) points out that the purpose of accounting is to resolve social conflicts. In order to resolve social conflicts, accounting information must be understandable to the parties to whom it is communicated. Consequently, the principal must request information he can understand from the agent. Information that he cannot understand will be of no use to him in monitoring his relationship with the agent.

It should also be pointed out that most empirical tests on the agency theory suggest that employment contracts determine the permissible behaviour and actions of agents. For example, empirical tests generally support the assertion that capital investment decisions (Larcker, 1983), merger and acquisition decisions (Tehrani *et al.*, 1987; Walking and Long, 1984) and financial accounting procedure choices (Healy, 1985) are associated with managerial compensation plans. The empirical significance and meaningfulness of accounting measures appears to be dependent on the employment contracts of agents. As a result, the empirical identities of the attributes that describe the empirical properties of accounting phenomena are dependent on the employment contracts. Therefore, accounting measurements should not be seen as independent of particular places and factual occurrences, as implied in the

accounting literature. They are instead dependent on the contractual relationship between principal and agent.

8.5 Conclusions

Accountants believe that the concept of relativism does not hold on accounting information. Since accounting is a social science, this has cast doubt on its status as a measurement discipline. The discussion in this chapter has shown that the concept of relativism exists in accounting, and as a result the discipline should take cognizance of its effects.

The representational theory of measurement equates measurement to numerical coding. The accounting discipline should recognize that the theory of measurement that applies to it requires the recognition of the concept of relativism. It should also be noted that there is no agreement relating the concept of value to the amount of monetary units paid to acquire a commodity and as a result the relationship between this amount and the value of the commodity is relative to a particular frame of reference.

A summary of some of the main points from the analysis carried out in this chapter is given below:

- The accounting concept of measurement is not independent of particular places and factual occurrences as was previously thought. It is relative to a specific entity. Consequently, it follows that accounting measurements are incomparable without an adjustment for the differences in frames of references
- When the scientific concept of relativism is applied to the accounting concept of measurement, it indicates that the measurement of accounting phenomena is not a law of nature but rather a creation of the mind. This indicates that the judgments of an accountant are dependent on his intuition. It has been noted in this chapter that the cognition of an individual is influenced by the culture

under which he or she is operating. As a result, the culture of an organization plays a crucial role in the measurement of accounting phenomena.

- The specification of the attributes of accounting objects that are of use and of interest to measure is dependent on a specific entity. It is evident from this that the empirical identities of attributes of accounting phenomena are not independent of particular places or factual occurrences.
- The concept of contractual relativism in accounting suggests that contracts define permissible behaviour and actions that ultimately determine the judgment/ decision process. It is clear, then, that accounting quantifications are dependent on employment contracts.

The discussion in this chapter has highlighted the point that the empirical relational structures of accounting phenomena are relative to a specific entity. It has also been noted that accounting measurements are relative to a specific entity. It can thus be concluded that accounting measurement should be evaluated relative to a specific frame of reference.

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

9.1 Introduction

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

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

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

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

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

9.2 The compatibility of the balance sheet with representational measurement

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

9.3 The compatibility of the income statement with representational measurement

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

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

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

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

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

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

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

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

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

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

9.5 The compatibility of the cash flow statement with representational measurement

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

9.7 Representational measurement and the concept of classification in financial statements

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

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

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

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

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

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

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

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

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

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

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

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

9.8 Representational measurement and performance measurement

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

9.8.1 Representational measurement and earnings per share

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

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

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

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

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

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

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

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

9.8.2 Representational measurement and the concept of economic value added

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

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

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

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

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

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

9.8.3 Representational measurement and ratio analysis

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

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

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

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

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

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

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

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

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

9.9 Conclusion

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

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

A summary of the present analysis indicates that:

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

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

Chapter 10- The meaningfulness of accounting information

10.1 Introduction

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

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

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

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

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

The chapter goes on to discuss the relationship between meaningfulness and permissible statistics in section 10.2.5. In section 10.3 a discussion of whether or not necessary and sufficient conditions exist for accounting information to be considered meaningful under the accounting conceptual framework is presented. The implications of statutory reporting requirements on the concept of meaningfulness are discussed in section 10.4, followed by an outline of the implications of the accounting concept of a scale on meaningfulness in section 10.5. A brief discussion of the implications of the going concern concept on meaningfulness is provided in section 10.6, followed by the implications of the objectivity of accounting phenomena for meaningfulness in 10.7 and the implications of the presentation of financial statements for meaningfulness in section 10.8. The chapter also discusses the relationship between meaningfulness and logic of hypothesis testing in section 10.9. The conclusion is reached in section 10.10.

10.2 The concept of representational meaningfulness

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

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

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

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

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

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

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

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

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

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

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

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

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

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

10.2.1 Meaningfulness and nominal scales

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

10.2.2 Meaningfulness and the ordinal scale

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

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

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

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

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

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

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

$$\begin{array}{c}
 b \\
 S \longrightarrow N \quad \text{such that; } k > m \iff b(k) > b(m), \text{ for all } k, m \text{ that are elements of } S.
 \end{array}$$

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

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

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

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

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

10.2.3 Meaningfulness and the interval scale

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

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

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

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

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

10.2.4 Meaningfulness and ratio scales

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

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

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

10.2.5 Meaningfulness and permissible statistics

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

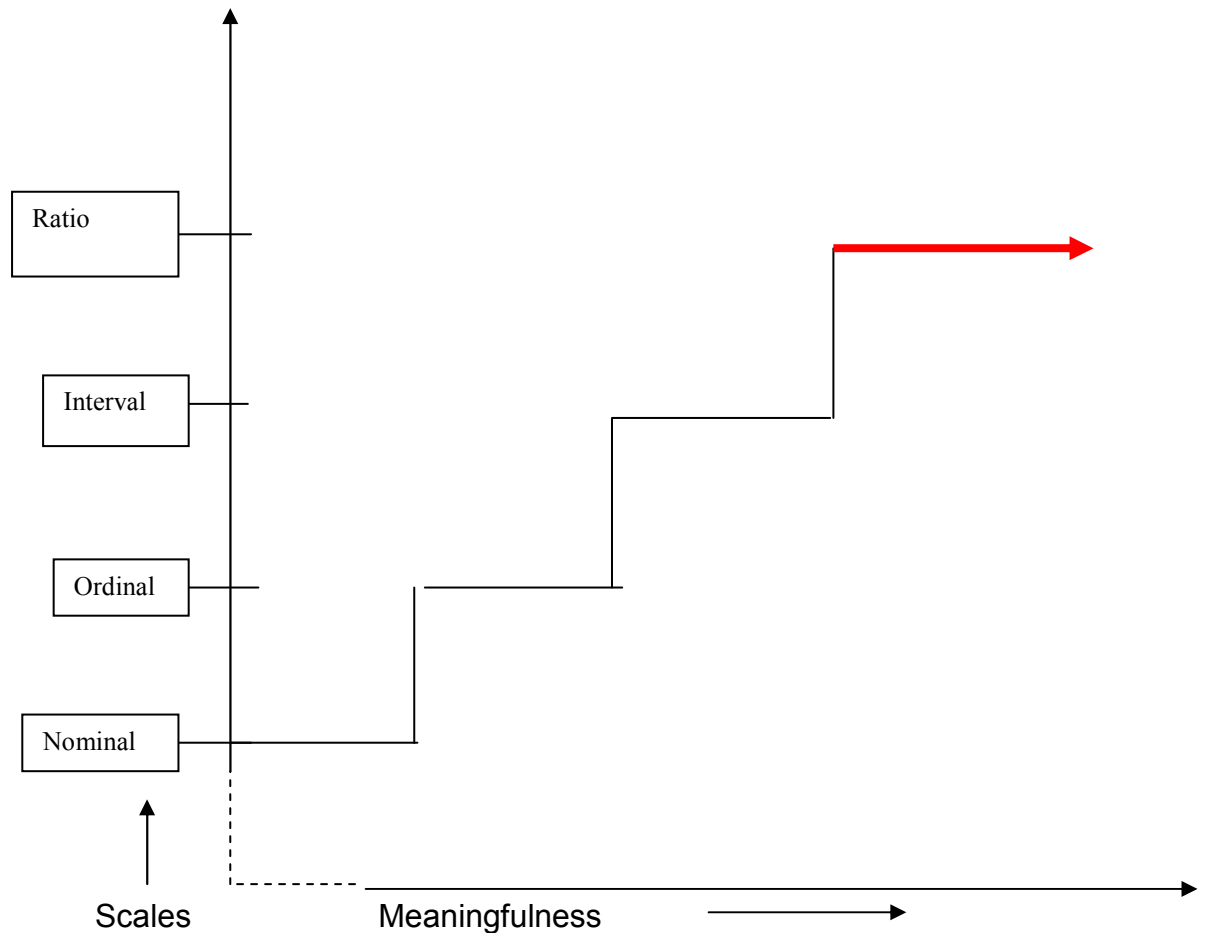
In the accounting discipline, authors such as Chambers (1997), Willet (1987), Staubus (2004) and Ryan *et al.* (2002) assert that the scale of measurement between value and monetary units is not specified. This means that the relationship between monetary units and value is not known. In section 10.2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

Luce *et al.* (1990:294) also suggest that the link between meaningfulness and statistics is obvious. They argue that statistical calculations involve various numerical functions $f(x_1 \dots x_k)$, such as the arithmetic mean or the standard deviation, for a set of measurements (e.g., x_1, \dots, x_k), and as a result it seems reasonable to require that the numerical relations defined by such functions be meaningful relative to the underlying empirical structure. This demonstrates that statistical analysis of measurement information that is meaningful is equivalent to the mapping of measurement information onto an abstract structure, while preserving the structure of the phenomenon that is represented by the measurement information. It also follows that statistical analyses on measurement information should be meaningful relative to the underlying empirical structure. It can therefore be concluded that the term meaningfulness is used to capture the idea that information may have little, or a great deal of, meaning in the sense that it conveys knowledge about an object or state of affairs.

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

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

Figure 10.1 Stevens' scales of measurement against the concept of meaningfulness



Source: Own Observation

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

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

10.3- Meaningfulness and the accounting conceptual framework

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

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

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

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

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

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

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

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

10.4 Meaningfulness and statutory requirements

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

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

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

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

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

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

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

10.5 Meaningfulness and the accounting concept of a scale

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

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

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

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

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

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

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

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

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

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

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

10.6 Meaningfulness and the going concern concept

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

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

10.7 Meaningfulness and the objectivity of accounting phenomena

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

Similarly Narens (2002: 761) states:

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

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

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

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

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

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

10.8 Meaningfulness and the presentation of information in the financial statements

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

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

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

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

10.9 Meaningfulness and the logic of hypothesis testing

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

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

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

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

10.10 Summary and Conclusions

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

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

- The meaningfulness of statements about measurement data is preserved under transformations that are permissible on that data. Permissible transformations are those transformations that leave the scale of measurement used in a process of measurement invariant. A scale of measurement specifies the statistical procedures that may be carried out on measurement information. The concept of meaningfulness is an all or nothing concept. Either a statement is meaningful or it is not.
- The object of measurement in the accounting discipline is value or cost. Monetary units are used to represent the value of the elements of financial statements. This means that in the accounting discipline, meaningful

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

- In the accounting discipline there are no specified scales of measurement. Yet measurement information is meaningful once a scale of measurement is specified. Therefore, it is clear that accounting measurement information is currently not meaningful.
- The value of an element of the financial statement is ambiguous. Thus, it follows that the value of such an element cannot be empirically tested. This means that the invariance of value cannot be established when a statistical procedure is performed on measurements of value. It follows from this that the meaningfulness of accounting information cannot be established.
- The statements prepared under going concern are dependent on subsequent events. These statements cannot be empirically verified. It has been noted in this chapter that meaningful statements are those whose invariance can be established. Therefore, it is clear from this that the meaningfulness of statements prepared under going concern cannot be established.
- In this chapter attention has been drawn to the fact that accounting information is presented in a way that is not consistent with the principles of representational meaningfulness. Monetary amounts representing different elements of financial statements are added or subtracted to or from each other. Such additions can only take place if it can be proved that the monetary amounts represent identical attributes of the elements of the financial statement, under the same scale of measurement. In the accounting discipline it is not known whether different monetary amounts in financial statements represent identical attributes. As a result, such additions are not permissible.

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

Chapter 11 –Empirical research design, methods and techniques

11.1 Introduction

In chapter 1 the concept of measurement as a mathematical concept was discussed. Its use in disciplines outside mathematics involves trans-disciplinary study. At present, accounting is considered to be a measurement discipline. This suggests that the accounting concept of measurement involves trans-disciplinary study. It follows that knowledge of the accounting concept of measurement also requires knowledge of the mathematical principles of measurement.

According to Mattessich (1964), accounting measurements are dependent on the judgement of accountants. This means that the selection of the attributes to be measured and the application of the principles of measurement in measuring the attributes is dependent on the accountant. Accounting is a social science (Ryan *et al.*, 2002). In chapter 1 it was noted that the theory of measurement that is applicable to the social sciences is the representational theory of measurement. Accountants must thus be familiar with the principles of the representational theory of measurement before they can measure the attributes of accounting phenomena.

The main focus of this chapter is to describe the research design and the research methods and techniques that were employed in the questionnaire survey. The research methodology employed in applying the representational theory of measurement to accounting practices was described in chapter 2. In conducting the questionnaire survey, recognized research methods were employed, namely, a literature survey and a questionnaire (Ryan *et al.*, 2002). A comprehensive literature survey was undertaken and a questionnaire was prepared and sent to members of the South African Institute of Chartered Accountants.

According to Mouton (1998), the nature of the research methodology chosen is dependent on the nature of the research problem and the research objectives. The objective of this questionnaire survey was to determine whether or not accountants are aware of the status of the harmony between the accounting concept of measurement and the principles of the representational theory of measurement. This involved testing whether members of the South African Institute of Chartered Accountants are familiar with the principles of representational measurement and their application. The goal of this chapter is to discuss the research design and the research methods and techniques that were used in the questionnaire survey.

This chapter commences with a discussion of the research design in section 11.2 and its subsection 11.2.1. In section 11.3 and its subsections the research methods and techniques used in the questionnaire survey are discussed. The conclusion to the chapter is contained in section 11.5.

11.2 Research Design

The research design constitutes the blueprint for the collection, measurement and analysis of data. It is a plan according to which we obtain research participants and collect information from them (Welman, and Kruger, 2005). The factors taken into account in conducting in this research are described in the sections that follow.

11.2.1 Control of Variables

One of the objectives of this study is to determine whether or not accounting is a measurement discipline. Part of this objective is achieved by sending out questionnaires to members of the South African Institute of Chartered Accountants to determine if they are familiar with the principles of measurement. Mattessich (1964:79) asserts that accounting measurements are measurements by fiat. Measurements by fiat are dependent on the intuition of the experimenter. This means that accounting measurements are dependent on the opinion of the accountant. Therefore, in order to understand the variable that determines accounting measurement it is necessary to understand the opinion of accountants

on the concept of accounting measurement. In order for chartered accountants to be able to measure, they must be able to tell which numerical assignments give rise to measurements and which do not. To do this, chartered accountants must be familiar with the principles of measurement that establish measurements in the social sciences.

11.3 Research methods and techniques

11.3.1 Setting up the questionnaire

Statements were compiled on the basis of a literature review. The questionnaire is presented in Appendix A and the questionnaire results are discussed in chapter 12. Statements in the questionnaire items were evaluated on a 5-point agreement Lickert scale rating. Respondents were requested to indicate on a scale rating

S/D Strongly disagree

D Disagree

U Unsure

A Agree

S/A Strongly Agree

the extent to which they disagreed/agreed with each statement. The theme of the statements centred on the hypothesis of the study, that is, accountants are not aware that the accounting concept of measurement is not in harmony with the principles of representational measurement. The accounting concept of measurement must be in harmony with the principles of the representational theory because this theory of measurement establishes measurement in social science. In chapter 1 it was noted that accounting is a social science. Consequently, it follows that accounting measurements must be compatible with representational measurements.

The statements in the questionnaire were selected on the basis that they are statements made by:

- a) Other researchers extracted from research literature-. There are statements about measurement that have been made by researchers in

measurement (e.g., Stevens, 1951) that this study regards as relevant to the research enquiry. There are also statements about accounting measurement that have been made by researchers in accounting measurement (e.g., Larson, 1967; Stamp, 1981) that have been judged to be relevant to the research enquiry. The use of such statements ensures that the analysis of the responses to the statement is backed by literature. This makes the analysis more credible.

- b) The researcher, based on research literature- The analyses carried out in chapters 1 to 10 have indicated that accountants and accounting researchers have poor knowledge of the principles of the representational theory of measurement. It was noted in chapters 1 to 10 that accounting researchers (e.g. Gilman, 1939; Ijiri, 1975, 1967; Littleton, 1953; Paton and Littleton, 1940; Sterling, 1966) have not used the principles of the representational theory of measurement in their attempts to create a theory of accounting measurement. The researcher has studied measurement literature comprehensively (e.g., Luce *et al.*, 1971, 1989, 1990), and is consequently considered to be in a position to formulate statements that can be used in the questionnaire.

The questionnaire is divided into six areas of enquiry. These areas test whether accountants are aware or not that the accounting concept of measurement is in harmony with the principles of the representational theory of measurement. Each of the sections in the questionnaire is discussed below:

1. Measurement in the accounting conceptual framework context – This section consists of five (1-5) statements, stated as follows:

1. *The accounting conceptual framework provides a foundation that sets the objectives and concepts that underlie the measurement of the attributes of economic phenomena.*
2. *Information is understandable and useful to users if it possesses the quality of meaningfulness.*

3. *Accounting information is relevant to the economic decision-making needs of the users if it is meaningful to the users.*
4. *Reliable information is information that can be empirically verified.*
5. *The comparability of accounting information is possible when the conditions of comparability are specified.*

The first statement tests whether accountants view the accounting conceptual framework as a framework for accounting measurement. The critical literature analyses carried out in chapters 3 to 10 indicate that the accounting concept of measurement is not consistent with the principles of the representational theory of measurement. However, the current accounting literature (e.g. Bierman, 1963; IASB, 2006; Wolk *et al.*, 2001) asserts that accounting is a measurement discipline. The purpose of the first statement is to evaluate whether or not accountants believe that accounting is currently a measurement discipline.

The other four (2-5) statements in this section test whether accountants are aware of the link between the qualitative characteristics of financial statements and the concept of meaningfulness in representational measurement. It was established in chapter 10 that financial statements can only possess qualitative characteristics (reliability, understandability, relevance and comparability) if they possess the quality of meaningfulness.

2. Measurement and the nature of accounting phenomena- This section consists of five (6-10) statements. These are stated as follows:

- 6) *The future economic benefits that are expected to flow from an asset are measurable.*
- 7) *Liabilities have measurable attributes.*
- 8) *Under the accounting conceptual framework it is possible to measure the income generated by an entity in a particular accounting period.*
- 9) *The attributes of expenses are measurable.*
- 10) *It is possible to measure the attributes of future events.*

This section tests whether accountants are aware that the elements of financial statements do not have attributes that are measurable at the moment. This is

because currently the IASB (2006) framework for financial reporting points out that items that meet the definition of an element of financial statements must have attributes that are measurable if they are to be recognized in the financial statements. However, it has been established in chapter 6 that the elements of financial statements do not have measurable attributes under the current accounting conceptual framework. It follows that if accountants are aware that the accounting concept of measurement is not consistent with the principles of the representational theory, then they should know that the elements of financial statements do not have measurable attributes that describe value under the current accounting conceptual framework.

3. Measurement and the recognition of accounting phenomena- This section consists of five (11-15) statements. These are as follows:

- 11. An item that meets the definition of an element of financial statements should be recognized if the item has a cost or value that can be measured with reliability.*
- 12. Valuation is a process that is similar to measurement.*
- 13. Value determinations continually refer to future states (Smith, 1956:116).*

This statement highlights the fact that the processes of determining value are concerned with the future states of value. This indicates that value is a forecast. It can also be inferred that value cannot be empirically tested. In chapter 2 it was noted that the principles of measurement are applicable to phenomena that can be empirically tested. Therefore, value is immeasurable.
- 14. Historical cost basis, current cost basis, realizable value basis, the present value basis and the fair value basis are theories of measuring value*
- 15. The amount of monetary units paid to acquire a commodity is a measure of its value.*

This section tests whether accountants are aware that the principles for the recognizing items that meet the definition of an element of the financial statement are not in harmony with the principles of the representational theory of

measurement. The IASB (2006) framework for financial reporting points out that before a transaction or event is recognized as an element in the financial statement, it must possess a cost or value that can be measured with reliability. However, it has been established in chapter 7 that value and cost are not measurable under the current accounting conceptual framework. Furthermore, it was established in chapter 6 and 7 that the accounting methods of determining value are not in harmony with the principles of the representational theory of measurement. Therefore, if accountants are familiar with the principles of representational measurement they should also be aware that the principles for recognizing the items that meet the definition of elements of financial statements are not in harmony with the principles of the representational theory of measurement.

4. The integrity of accounting information created under the accounting conceptual framework-This section consists of seven (16-22) statements, specified as follows:

16. *Future events do not represent reality.*
17. *Estimates in accounting reflect measurements of the attributes of economic transactions.*
18. *Accrual accounting is mainly concerned with the measurement of the attributes of future accounting phenomena.*
19. *Income is an ambiguous concept, and is not an intrinsic property of an accounting entity (phenomenon) (Stamp, 1981).* This statement points out that the income of a business entity cannot be objectively determined. This means that income cannot be empirically tested. In chapter 2 it was noted that the principles of measurement are applicable only to empirical phenomena. It can therefore be concluded from this that income is immeasurable, as it cannot be empirically verified.
20. *Value is an ambiguous concept, and it is not an intrinsic property of an accounting entity (phenomenon) (Stamp, 1981).* This statement indicates that value cannot be determined objectively. Value cannot thus be

empirically tested. In chapter 2 it was noted that the principles of measurement are applicable only to empirical phenomena. It follows then that the value of an element of the financial statement is immeasurable.

21. The attributes of accounting phenomena are dependent on the judgement of the accountant

22. Value is whatever two people are willing to trade for.

This section tests whether accountants are aware that the information contained in the financial statements describes phenomena that are not objective. This information is supposed to be objective accounting measurement information. However, it has been noted in chapter 7 that the phenomena that are described by accounting measurement information in financial statements are not objective. But, 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 (Decoene *et al.*, 1995). This means that all measurements must be empirical. It follows that if accountants are familiar with the principles of representational measurement, they should also be aware that measurement is only possible with empirical phenomena.

5. Measurement and the concept of time and accounting measurements-

This section consists of seven (23-29) statements. These statements are outlined as follows:

23. The going concern assumption is necessary for accounting measurement to occur.

24. It is possible to measure periodic income under the going concern assumption.

25. Under the going concern assumption the statement of financial position reflects true measurements of assets and liabilities.

26. The valuation of assets and liabilities can only occur under the going concern assumption.

27. *The values of assets can be meaningfully added to each other in the balance sheet.*
28. *The values of the items of income in the income statement can be meaningfully added and subtracted from each other.*
29. *The income generated by cash sales and credit sales can be added to each other.*

This section tests whether accountants are aware that all measurements are dependent on the concept of time. All measurements are made at a specific point in time. For example, Sterling (1979) points out that the purpose of the measurement is to discover a magnitude at that point in time without regard to what has gone before or what will come after that point. However, it has been established in chapter 5 and chapter 9 that the accounting concept of measurement does not recognize that measurements occur at a specific point in time. In particular, this is demonstrated by the going concern concept. Sterling (1968) highlights the point that all the statements prepared under the going concern are provisional and dependent on subsequent events. Therefore, if measurement occurs at a point in time without regard to what has gone before or what will come, it means that measurement cannot occur under the going concern concept, since all statements prepared under going concern are dependent on subsequent events.

6. The principles of representational measurement- This section consists of eight (30-37) statements, which are outlined below as follows:

30. *Measurement refers to any method of assigning numbers to represent properties or qualities, according to some set of rules (Larson, 1969).* This statement reflects that there may be many ways of measuring an empirical phenomenon. It can also be inferred from this statement that a process of measurement consists of a specified set of rules of measurement and specified properties or qualities to be measured. The properties and

- qualities of phenomena are mapped on to natural numbers. Measurement occurs by mapping properties of objects onto natural numbers.
31. *Measurement is a relative matter (it varies in kind, degree, type and precision) (Stevens, 1951).* This statement points out that measurements taken in different environments should not be compared unless they have been converted to a common set of measurement circumstances. It follows that accounting measurements made by different companies in different circumstances should not be compared unless they have been converted to a common yardstick of measurement.
 32. *Every measurement system requires the specification of a scale of some kind (Chambers, 1997).* This statement points out that every process of measurement can only be considered as such if there is a specified scale of measurement. This suggests that in accounting all the processes that are referred to as processes of measurement should have specified scales of measurement. For example, the process of assigning monetary units to the value of an element of the financial statement should have a specified scale of assigning the units of value to monetary units.
 33. *An empirically true value of a measured quantity does not exist (Margenau, 1959).* This statement reflects that there is no measurement that is accurate. All measurements must reflect an element of error. This means that if accounting is a true measurement discipline, all accounting measurements must reflect the concept of error.
 34. *Measurement requires the specification of a property to be measured (Chambers, 1997).* This statement reflects that every property that is subject to measurement must be specified. In chapter 3 it was noted that the object of measurement in accounting is value. This means that the properties of value must be specified for measurement to occur.
 35. *Every measurement system requires the specification of a unit in the scale (e.g., Rands, kilogram, etc.) (Luce et al., 1990).* The specification of a unit of

measurement makes a measurement unique. According to Luce *et al.* (1990) the specification of the representation to which a measurement relates gives meaning to the measurement. Statements about a measurement have significance if the phenomenon to which the measurement relates is specified. For example, it is necessary to specify whether the height of a man is in metres or in inches.

36. Measurement should take place under specified conditions

37. In a measurement discipline, the property to which numbers will be assigned must be measurable

This section tests whether accountants are familiar with the principles of the representational theory of measurement. In chapter 1 it was stated that accounting measurements are dependent on the opinion of the accountant. This means that the accountant must be familiar with the principles of measurement that are applicable to accounting and which establish measurement in accounting. In chapter 1 it was also highlighted that the principles of measurement that are applicable to accounting are the representational theory of measurement. It follows that accountants must be familiar with the principles of the representational theory of measurement. According to Stevens (1951), measurement is more immediately the goal of the experimental corner where the patient sifting of facts and relations has disentangled some of the relevant variables. This means that measurement depends on how well the experimenter understands the situation at hand. The experimenter must understand the principles of representational measurement in order to be able to apply them well enough. Furthermore, Mattessich (1964:79) states, "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 also suggests that the measurement of economic phenomena is dependent on the intuition of the accountant. Therefore, if accountants are to measure economic phenomena, they have to be well versed in the principles of representational measurement, which establish measurement in accounting. It can be inferred from this that an

accountant who is knowledgeable about the principles that establish measurement in accounting is in a better position to judge whether the numerical assignment he or she has made is compatible with the principles of measurement applicable to that discipline.

11.3.2 Pilot testing

A pilot test was conducted during July 2007. The expert opinions of eight senior researchers at the University of Pretoria in the department of financial management were obtained. Minor changes were made to the wording of the statements.

11.3.3 Preparing a mailing list

The population of chartered accountants was defined in terms of the mailing list. Returned electronic questionnaires constituted convenience sampling of the relevant group.

11.3.4 Target population

The process of defining the population involves the identification of the target population and the construction of the sampling frame. Du Plooy (2001:100) defines the population as all possible units of analysis, while the target population is the population to which the findings will be generalised. If this is the case, it follows that the population for this study includes all accountants in the world, while the target population includes only those registered under the South African Institute of Chartered Accountants.

The objective of this study is not to generalise the findings to the target population. It should be noted that even though there is an empirical component to this study, as a whole it is exploratory in nature. Very little research has been done on the application of the representational theory of measurement to accounting. However, this is not necessarily problematic in terms of the definition of the concept “target population”. In this study, target population refers to those

units of analysis that are applicable in terms of the research problems and objectives.

11.3.5 Sampling frame

Before researchers draw a sample from the population for analysis, they should obtain clarity about the population, or units of analysis, to which their research hypotheses apply. This involves compiling a sampling frame. According to Cooper and Schindler (2003), the sampling frame can be described as a demarcation of the target population. They assert that the sampling frame is the list of elements from which the sample is actually drawn. It is a complete list in which each unit of analysis is mentioned only once. Ideally, the sampling frame should include all members of the target population. However, this is not always possible.

The study is conducted in South Africa and so the members of the South African Institute of Chartered Accountants were used because of the easy access to them. With respect to this study, the sampling frame does not include all the elements in the target population. In this study all the elements of the target population refers to all members of the South African Institute of Chartered Accountants. This is partly because the inclusion of all these elements is costly and, in addition, the South African Institute of Chartered Accountants does not give out the names or email addresses and contact details of its members.

The South African institute of Chartered Accountants, which is the largest body of qualified accountants in South Africa, has been chosen ahead of other professional Accounting Bodies around the world because the research is being conducted in South Africa. The mailing costs of the research will be reduced if the study is conducted in South Africa.

11.3.6 Sampling technique

The basic idea of sampling is that, by selecting some of the elements in a population, it may be possible to draw conclusions about the entire population. According to Du Plooy (2001), sampling is a rigorous procedure of selecting units of analysis from a larger population. Sampling can be probabilistic or non-probabilistic. Cooper and Schindler (2003) assert that probability sampling is based on the concept of random selection. Random selection is a controlled procedure that assures that each population element is given a non-zero chance of being selected. On the other hand, non-probabilistic sampling is subjective and arbitrary. Each member does not have a known non-zero chance of being included. Probability sampling is used if the objective of the research project is to generalize the findings to the population. In this case, a sample should be representative of the population. According to Welman and Kruger (2005), a representative sample is a miniature image or likeness of the population. But, if the study is exploratory in nature, with less concern about the sample's representativeness, then non-probability sampling is appropriate.

The statistics department at the University of Pretoria was employed in the design of this sample. It was noted that the South African Institute of Chartered Accountants does not provide a list of all its members. In light of this, it was recommended that the researcher in this study have the freedom to choose any member of the Institute he could find. As a result, this study has used convenience sampling.

11.3.7 Compiling a database

Due to the fact that the South African Institute of Chartered Accountants does not give out a list of names and addresses of its members the total population of chartered accountants in South Africa is not known. The researcher decided to compile a list of names and physical addresses of registered chartered accountants and auditors in the areas close to the university. This list was obtained from the telephone directory and from the list of registered accountants

and auditors as at 31 March 2006, and this was also used to represent the population of chartered accountants.

Names and email addresses of chartered accountants who are lecturers at South African universities were also obtained from university websites. However, not all universities had email addresses for their lecturers on their websites. It should also be noted that questionnaires were also hand delivered to the accounting departments of the universities that were accessible to the researcher.

11.3.8 Distribution of questionnaires

Electronic questionnaires directed at chartered accountants were sent out to companies listed on the Johannesburg Stock Exchange and to chartered accountants who are lecturers, whose email addresses could be found on university websites. As far as the respondents who were in the vicinity of the researcher are concerned, the questionnaire was hand delivered and collected in person by the researcher. Delivering and collecting the questionnaire by hand ensures a high response rate from the respondents.

11.3.9 Receiving the responses

As the total population of chartered accountants could not be determined, use was made of non-probabilistic convenience sampling. As such, representativeness cannot be guaranteed. Since the study was regarded as exploratory it was argued (Kerlinger, 1986) that all respondents included possessed the basic characteristics that the greater population of chartered accountants would possess and that these were being researched in this study. As such, they are representative of the population in a sense but since representativeness could not be guaranteed, generalizations about the population as a whole should be approached with caution.

11.4. Recording the responses

A record of all responses was kept in a Google mail account. These responses were matched with the original email message. Some respondents replied by fax. All the faxes reflected the names and addresses of the companies. This facilitated the matching of responses to original sent emails. In this way, companies that did not respond to the first email could be reminded.

11.4.1 Follow up

Regular weekly visits to the premises of the respondents whose questionnaires were delivered by hand were made. Four weeks after the first emails had been sent, a reminder was sent to all those who had not yet responded. At that stage, a total of 55 completed questionnaires, electronic and hand delivered, had been received. The cut-off date was 4 December 2007. By this date a total of 111 questionnaires had been received. These were analyzed and reported as results in chapter 12.

11.5 Conclusion

In this chapter the various research methods used in this study were described. These methods include a literature survey and the use of questionnaire. The literature review undertaken in chapters 2 to 10 was necessary in order to formulate the statements in the questionnaire which are discussed in chapters 11 and 12.

In order to investigate whether accountants are aware that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement, a questionnaire was developed in MS Word format, making use of the literature review findings discussed in chapter 2 to chapter 10. The questionnaire is aimed at chartered accountants who are members of the South African Institute of Chartered Accountants. As the total population of the South African Institute of Chartered Accountants could not be determined, use was made of non-probabilistic convenience sampling. As such,

representativeness cannot be guaranteed. Since the study is regarded as exploratory, it is argued that all respondents possessed the basic characteristics that the greater population of chartered accountants would possess and that these were being researched in the study.

Chapter 12-Research results – questionnaires for accountants

12.1 Introduction

Accountants are important role players who influence the application of the principles of the representational theory of measurement to accounting. Mattessich (1964) classified accounting measurements as measurements by fiat. This means that they are dependent on the intuition of the accountant. It is therefore important that accountants are familiar with the principles of measurement that establish measurement in accounting and their application so that they can evaluate whether or not a particular numerical assignment is compatible with the principles of measurement. It was noted in chapter 2 that the principles that establish measurement in accounting are those of the representational theory of measurement. It follows that accounting cannot be a measurement discipline unless accountants are familiar with the principles of the representational theory of measurement and their application.

It has been established in chapters 1 to 10 that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement. The results of the literature review, which are reported generally throughout this thesis, support the main theme that accounting is not a measurement discipline. As such, a questionnaire was distributed to chartered accountants. The questionnaire contained 37 statements that were divided into six sections of enquiry that are bulleted below as follows:

- Section 1: Measurement in the accounting conceptual framework context
- Section 2: Measurement and the nature of accounting phenomena under the accounting conceptual framework
- Section 3: Measurement and the recognition of accounting phenomena

- Section 4: The integrity of accounting information created under the accounting conceptual framework
- Section 5: Measurement and the concept of time under the accounting conceptual framework
- Section 6: The principles of representational measurement

The respondents were asked to indicate whether they strongly agreed, agreed, disagreed or strongly disagreed or were unsure about the statements.

The purpose of this chapter is to report on the findings from the questionnaire survey. A discussion of each statement in the questionnaire is conducted. This chapter commences with a discussion of the results of the questionnaire in section 12.2 followed by an analysis of the responses in section 12.21. In section 12.3 the conclusion closes the chapter.

12.2 Results of the questionnaire

The questionnaire was distributed electronically to companies listed on the Johannesburg Stock Exchange and to chartered accountants who are lecturers and whose email addresses could be found on university websites. For the respondents who were in the vicinity of the researcher, the questionnaire was hand delivered and collected in person by the researcher. This method of delivery was chosen because the total population of the members of the South African Institute of Chartered Accountants is not known as Institute does not issue names and addresses of its members. Convenience sampling was used in respect of the population of chartered accountants. This statistical method was cleared with the statistician consulted for this thesis. The sample of 111 completed questionnaires represents the total of completed replies that were actually received from respondents. The response rate is not given for the total population of the members of the South African Institute of Chartered Accountants as it is not known.

12.2.1 Responses to the questionnaire

In the subsections that follow the responses received per statement are presented in the following order: the statements are classified according to six sections, the purpose of each section is outlined, a display of the statement, a short motivation, the results displayed in a table and a discussion of the outcome. A conclusion on the outcomes of all the different sections of the questionnaire will close the chapter.

Section 1: Measurement in the accounting conceptual framework context

This section is designed to investigate whether accountants truly believe that the accounting framework is a framework that outlines the foundations of accounting measurement. It has been noted in chapter 10 that financial reporting is regulated by a statutory framework (see, Companies Act, 1973). This means that the statutory framework regulates accountants' activities. It was established in chapter 6 that the foundations of accounting measurement outlined in the accounting conceptual framework (IASB, 2006), whose use is enforced by the Companies Act of 1973, are not in harmony with the principles of representational measurement. This means that the Companies Act of 1973 is enforcing the use of accounting principles of measurement that are not in harmony with the principles of representational measurement. If this is the case, it can be inferred from this that the measurement beliefs of accountants that are reflected in accounting measurement practices might be because they have no choice to make in accounting measurement but just to follow the statutory regulations, when in fact they are aware that the foundations of accounting measurement outlined in the accounting conceptual framework are not in harmony with the principles of the representational theory of measurement.

Furthermore, the IASB framework (2006) for financial reporting views its objectives as the establishment of a basis for determining which events should be reported, how they should be measured and the format in which they should be

communicated to users. This gives the impression that the conceptual framework establishes the basis of accounting measurement. It is therefore necessary to determine whether accountants consider the framework to be a basis of accounting measurement.

The section also investigates whether accountants are aware of the link between the qualitative characteristics of financial statements and the measurement concept of meaningfulness. The IASB framework (2006) for financial reporting points out that accounting information is useful to users if it possesses the qualities of relevance, reliability, understandability and comparability. In chapter 10 it was noted that the characteristics of relevance, reliability, understandability and comparability could only be possessed by information that reflects the measurement characteristic of meaningfulness. Furthermore, as has been noted in chapter 10, the quality of meaningfulness is fundamental to all measurement information. It has also been noted that accounting information is not currently meaningful. It is therefore necessary to test whether accountants are aware of the link between the qualitative characteristics of financial statements and the concept of meaningfulness. The analysis of the responses to the statements in this section is reflected below.

Statement 1: *The accounting conceptual framework provides a foundation that sets out the objectives and concepts that underlie the measurement of the attributes of economic phenomenon.* The IASB framework (2006) for the preparation and presentation of financial statements sets out the objectives and theoretical principles which form a reference for the accounting discipline. According to this framework, an item that meets the definition of an element of financial statements should be recognized if it has a cost or value that can be measured with reliability. In this case, the framework identifies cost and value as attributes whose measurement is necessary for an accounting event to be recognized. The framework goes on to outline the bases for measuring the cost or the value of economic events. However, as was established in chapter 6 and 7,

the characteristics of cost and value are not in harmony with the principles of the representational theory of measurement. They do not satisfy the criteria for measurability.

Furthermore, the characteristics of the bases (historical cost, current cost, realizable value, present value) of measuring value or cost in accounting are not in harmony with the principles of the representational theory of measurement. The analyses in chapters 3, 4, 5, 6, 9 and 10 also indicate that the principles of the accounting concept of measurement outlined in the IASB framework (2006) for the preparation and presentation of financial statements are not in harmony with the principles of the representational theory of measurement. This means that the accounting framework for financial reporting does not contain the principles of accounting measurement. Statement 1 tests whether accountants are aware that the framework of financial reporting does not contain genuine principles of accounting measurement. Table 12.1 shows the responses of the accountants to this statement.

Table 12.1: Statement 1

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	38	34.23	81.98
Agree	53	47.75	
Unsure	11	9.91	18.02
Disagree	7	6.31	
Strongly Disagree	2	1.80	
Total	111	100	100

The table indicates that 47.75 percent of chartered accountants agreed with statement 1 and 34.23 percent strongly agreed. The vast majority (81.98 %) of respondents are therefore in agreement with this statement. This suggests that the majority of chartered accountants view the accounting conceptual framework

as providing the foundations of accounting measurement. If this is the case it can be concluded that this majority is not aware that the accounting measurement prescriptions made under the accounting conceptual framework (IASB, 2006) are not consistent with the principles of the representational theory of measurement. Therefore, it can be concluded that the measurement beliefs of accountants that are reflected in the accounting practices of measurement are not only due to statutory requirements, but that they also reflect the true measurement views of accountants.

Statement 2: *Information is understandable and useful to users if it possesses the quality of meaningfulness.* The concept of understandability is one of the qualitative characteristics that financial statements should possess if they are to be considered useful to users. In chapter 1 it was noted that accounting is currently considered to be a measurement discipline. Luce and Narens (1994) point out that all measurement information must be meaningful, and that measurement information is meaningful if users understand the use to which the information may be put. This suggests that accounting information is understandable if the user knows the use to which the accounting information may be put. That is, the purpose of accounting measurement information must be specified. It must also carry a specific meaning under specific circumstances. In chapter 10 it was noted that measurement information carries a specific meaning under a specific set of circumstances. This measurement information is said to be invariant or meaningful under the circumstances. It follows that information is understandable to a user if this user understands what it represents, what its purpose is and what it may be used for. It was established in chapter 10 that the accounting information in financial statements is not meaningful. Statement 2 tests whether chartered accountants are aware that accounting information is understandable to users if it possesses the quality of meaningfulness. Table 12.2 reflects the responses to statement 2.

Table 12.2: Statement 2

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	42	37.84	93.7
Agree	62	55.86	
Unsure	3	2.70	6.3
Disagree	4	3.60	
Strongly Disagree	0	0	
Total	111	100	100

From table 12.2 it is clear that 37.84 percent of chartered accountants strongly agree with statement 2, while 55.86 percent agree with the statement. It follows that 93.7 percent of the respondents are therefore in agreement with this statement. This suggests that chartered accountants recognize the link between the measurement concept of meaningfulness and the qualitative characteristic of understandability. It can therefore be concluded from this survey that the majority of accountants are aware of this link. It can also be inferred that accountants are aware that users of accounting information need to understand the measurement procedures that accountants employ in measuring the attributes of accounting phenomena for this information to be useful to them. It follows that users must understand the production of accounting information for them to be able to understand its uses.

Statement 3: *Accounting information is relevant to the economic decision-making needs of the users if it is meaningful to the users.* Information is relevant to the economic decision-making needs of the user if its use in that particular economic decision-making situation is known. The user can only judge the relevance of measurement information to a decision-making situation if he or she knows the type of information that is relevant for that particular decision, and if he or she knows the uses of the information at hand and the purpose for which it has been produced. Narens (2002) points out that measurement information is meaningful if

the use to which the information may be put is known. Consequently, this viewpoint ties the measurement concept of meaningfulness to the relevance of accounting measurement information to the economic decision needs of the user.

This statement tests whether accountants are aware that accounting measurement information is relevant to economic decision-making needs of the user if it is meaningful to the user. Table 12.3 indicates the responses of chartered accountants to statement 3.

Table 12.3: Statement 3

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	41	36.94	96.4
Agree	66	59.46	
Unsure	1	0.90	3.6
Disagree	3	2.70	
Strongly Disagree	0	0	
Total	111	100	100

The table reflects that 59.46 percent of chartered accountants agree with statement 3, and 36.94 strongly agree: 96.40 percent of chartered accountants are therefore in agreement with statement 3. This indicates that the majority of chartered accountants are aware that accounting measurement information that is relevant to the decision-making needs of the user must also be compatible with the measurement concept of meaningfulness. This also suggests that accountants are aware that users must be familiar with accounting measurement procedures employed by accountants in producing accounting information so that they know whether the information produced is relevant to the economic decisions they are making.

Statement 4: *Reliable information is information that can be empirically verified.* In chapter 2 it was noted that reliable measurement information is information that is invariant. That is, all measurement information must be capable of being

empirically verified. Furthermore, Luce *et al.* (1971) state that a measure is supposed to represent the properties of an underlying empirical relational structure. This means that an analysis of a measurement should exhibit invariance that is appropriate to the structure underlying the measurement. It was noted in chapter 5 that accounting information is not reliable. It is also not empirically verifiable. According to Luce and Narens (1994), the concept of reliability is linked to the concept of invariance and meaningfulness. In other words, accounting information is not meaningful. This statement tests whether accountants are aware that all measurement information must be objective, invariant and meaningful. Table 12.4 highlights the views of chartered accountants with regard to statement 4.

Table 12.4: Statement 4

Rating Scale	Frequency	Percentage	Analysis of percentages
Strongly Agree	35	31.53	79.28
Agree	53	47.75	
Unsure	9	8.11	20.72
Disagree	14	12.61	
Strongly Disagree	0	0	
Total	111	100	100

Table 12.4 reflects that 31.53 percent of chartered accountants agree with statement 4 and 47.75 strongly agree with the statement. The majority (79.28 percent) are therefore in agreement with statement 4 suggesting the majority of chartered accountants is aware that reliable measurement information must be objective, invariant and meaningful. The information must retain its meaningfulness under different circumstances and users.

Statement 5: *The comparability of accounting information is possible when the conditions of comparability are specified.* According to Stevens (1951), measurement occurs under a specific set of circumstances. This means that

measurements can only be considered identical if they are produced under identical circumstances. It follows that if accounting information is measurement information, it can only be compared if it has been produced under identical circumstances. According to Stevens (1951), measurements are relative to the specific environment in which they have been produced. Different environments may produce different measures unless the measurement conditions are standardised. Conditions of comparability of measurements are specified when it is shown that measurements have been produced under identical conditions or when the conditions under which they *have been produced are adjusted so as to reflect identical circumstances* (Luce et al., 1990). This means that accounting information can only be compared if it has been produced under identical conditions or if the conditions are adjusted so as to reflect identical circumstances. It was established in chapter 9 that accounting information from different accounting periods and from different companies is frequently compared without specifying the conditions under which the information has been produced. It is necessary to specify the procedures used to elicit measurement information for it to be comparable. This statement tests whether accountants are aware that measurement information is comparable when it has been produced under identical circumstances. Table 12.5 reflects the responses of chartered accountants to statement 5.

Table 12.5: Statement 5

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	27	24.32	86.48
Agree	69	62.16	
Unsure	8	7.21	13.52
Disagree	7	6.31	
Strongly Disagree	0	0	
Total	33	100	100

The table shows that 62.16 percent of chartered accountants agree and 24.32 percent strongly agree with the statement: 86.48 percent of academic accountants therefore agree with statement 5. This suggests that the majority of chartered accountants are aware that measurement information is not comparable unless if it has been produced under an identical set of circumstances.

Discussion

The purpose of the statements in this section was to establish whether chartered accountants view the conceptual framework for financial reporting as a framework that genuinely outlines the foundations of accounting measurement, and to test whether chartered accountants are aware of the link between the qualitative characteristics of financial statements and the representational measurement concept of meaningfulness. The overall responses to the statements in this section indicate that accountants view the conceptual framework for financial reporting as one that outlines the foundations of accounting measurement and that the majority are aware of the link between the qualitative characteristics of financial statements and the measurement concept of meaningfulness.

It has been noted in this in study that the foundations of accounting measurement are not outlined in the accounting literature. In particular, Chambers (1997) notes that there are no specified scales of measurement in the accounting discipline. This suggests that chartered accountants are not aware that the accounting conceptual framework (IASB, 2006) does not outline the foundations of accounting measurement. The foundations that the accounting conceptual framework purports to specify are not in harmony with the principles of the representational theory of measurement.

With regard to the concept of meaningfulness, Narens (2002) points out that measurement information is meaningful once the scale of measurement has been specified. This suggests that no measurement information can be meaningful in the absence of a scale. Authors such as Chambers (1997), Willet (1987) and

Ryan *et al.* (2002) have noted that there are no specified scales of measurement in accounting. However, the responses in statement 1 indicate that chartered accountants believe that the accounting framework provides the foundations of accounting measurement when there are no specified scales of measurement. In other words, accountants do not appear to be familiar with the application of the concept of meaningfulness to measurement information. Consequently, this suggests that chartered accountants are not aware that the accounting conceptual framework (IASB, 2006) does not represent the foundations of accounting measurement. All that are referred to as foundations of accounting measurement are not in harmony with the principles of the representational theory of measurement. If accounting is to be considered a measurement discipline, it is necessary to develop principles of accounting measurement that reflect the measurement properties of this discipline.

Section 2: Measurement and the nature of accounting phenomena under the accounting conceptual framework

This section is designed to test whether accountants are aware of whether or not the nature of accounting phenomena under the current accounting conceptual framework is consistent with the principles of representational measurement. It has been noted in this study (Luce *et al.*, 1971) that the empirical relational structure of a phenomenon and its empirical properties must be invariant. This means that the set of axioms leading to the representation and uniqueness theorems may be regarded as a set of qualitative empirical laws. In a measurement space, the empirical attributes must be specified. It is therefore necessary that the attributes of accounting phenomena that are of use and interest to measure should be specified. According to Decoene *et al.* (1995), before measurement can take place there must be a thorough understanding of the empirical relational structure. This means that it is necessary to have a

thorough understanding of accounting phenomena before accounting measurement can take place.

It has been also noted in this study that the qualitative structures of accounting phenomena and their properties under the accounting conceptual framework are not invariant and are therefore not measurable according to the principles of representational measurement. Furthermore, it was remarked in chapter 6 that the attributes of accounting phenomena that are of use and interest to measure in the accounting discipline are not specified. The concept of measurement in accounting refers to the measurement of the qualities of the elements of financial statements (IASB, 2006). But, as mentioned in chapter 6, these elements do not have qualities that are measurable under the current accounting conceptual framework. Statements 6 to 10 test whether chartered accountants are aware of this.

Statement 6: *The future economic benefits that are expected to flow from an asset are measurable.* This statement tests whether accountants believe that under the IASB framework (2006) for financial reporting the future economic benefits that are expected to flow from an asset are measurable. The IASB (2006, Para 89) points out that an asset should be recognized in the balance sheet when it is probable that future economic benefits will flow to the entity from this asset. The use of the word “probable” implies that it is the expectation of future economic benefits whose properties have to be measured during recognition. Orbach (1978) points out that it is only expectations of future phenomena that are measurable. He also argues that expectations have legitimate properties in the present that are measurable. This means that the attributes of expectations exist in the present and they must be specified in order for them to be measurable in the present. It follows that in the accounting literature (e.g., IASB, 2006) there are specified attributes for future economic benefits that are expected to flow from an asset. However, Chambers (1997) notes that the properties of accounting phenomena that are measurable are not currently specified in the accounting literature. This means that the properties of the expectations of future economic benefits that are

measurable under the current accounting conceptual framework are not known. However, every measurement process requires the specification of the attributes that are of use and interest to measure (Ryan *et al.*, 2002). This suggests that the set of axioms that lead to the representation and uniqueness theorems in accounting measurement cannot be specified. It follows that the representation and uniqueness theorems that are fundamental to accounting measurement are not specified. As a result, the future economic benefits that are expected to flow from an asset are not currently measurable under the accounting conceptual framework. Table 12.6 reflects the views of chartered accountants.

Table 12.6: Statement 6

Rating Scale	Frequency	Percentage %	Analysis of Percentages
Strongly Agree	16	14.41	59.46
Agree	50	45.05	
Unsure	20	18.02	39.64
Disagree	24	21.62	
Strongly Disagree	1	0.90	
Total	111	100	100

It can be inferred from the table just over a third (39.64 percent) of chartered accountants disagree with the statement. This suggests that a significant proportion of chartered accountants are aware that under the current accounting conceptual framework (IASB, 2006) there are no specified attributes of accounting phenomena whose expectations can be measured. It can be concluded that approximately forty percent of chartered accountants are aware that the statutory financial reporting requirements are not in harmony with the principles of the representational theory of measurement.

The table also indicates that almost half (45.05 percent) the chartered accountants agree with statement 6 while 14.41 percent strongly agree. It follows

that 59.46 percent of the chartered accountants are therefore in agreement with statement 6. Therefore, the majority of chartered accountants are not aware that under the current accounting conceptual framework (IASB, 2006) there are no specified attributes of accounting phenomena whose expectations can be measured. It is clear from this survey that the majority of accountants are not aware that the future economic benefits that are expected to flow to a business entity are not measurable under the current accounting conceptual framework. In any measurement space, however, it is essential to specify the empirical attributes that are of use and interest to measure.

Statement 7: *Liabilities have measurable attributes.* This statement is designed to test whether accountants believe that liabilities have specified measurable attributes under the current accounting conceptual framework. In chapter 6 it was established that a liability does not have a precise definition under the IASB framework (2006) for financial reporting. This means that the properties of liabilities that can be empirically tested are not currently specified in the accounting literature. Authors such as Willet (1987), Staubus (2004) and Chambers (1997), note that liabilities do not have a precise definition, nor do they have any specified attributes that may be measured. The measurement axioms that lead to the representation and uniqueness theorems of measurement can be specified only once the object of measurement has been specified. Therefore, this suggests that the measurement axioms that lead to the representation and uniqueness theorems of accounting measurements of the attributes of liabilities cannot be specified. Table 12.7 reflects the views of the chartered accountants on statement 7.

Table 12.7: Statement 7

Rating Scale	Frequency	Percentage %	Analysis of Percentages
Strongly Agree	14	12.61	79.28
Agree	74	66.67	
Unsure	16	14.41	20.72
Disagree	7	6.31	
Strongly Disagree	0	0	
Total	111	100	100

The results in table 12.7 indicate that 66.67 percent of chartered accountants agree with statement 7 while 12.61 percent strongly agree. It can therefore be concluded that 79.28 percent of the chartered accountants are in agreement with the statement. It is clear from this survey that the majority of chartered accountants are not aware that liabilities have no measurable attributes under the current (IASB, 2006) accounting conceptual framework. It can also be concluded the majority of accountants is not aware that it is necessary to specify the object of measurement. In chapter 2 it was stressed that it is not possible to measure an unknown object. Therefore, the attributes of liabilities must be known before they can be measured.

Statement 8: *Under the accounting conceptual framework it is possible to measure the income generated by an entity in a particular accounting period.* This statement tests whether accountants believe that periodic income is measurable under the current accounting conceptual framework. Income is considered an ambiguous concept that is not an intrinsic property of an accounting entity (Stamp, 1981). This suggests that the qualitative structure of income and its properties cannot be considered to be invariant. The properties of income are dependent on the opinion of the accountant. As a result, the representation and uniqueness theorems cannot be proved on the axioms leading to the measurement of the attributes of income.

According to Luce and Narens (1994), proving the representation and uniqueness theorems is equivalent to specifying the scale of measurement. This means that the property that is being measured must be known for a scale of measurement to be specified. If the representation and uniqueness theorems cannot be proved on the measurement of income, it follows that under the representational theory of measurement a statistical analysis of the measurements that are supposed to represent the attributes of income cannot give a result that exhibits invariance appropriate to the structure underlying the measurements. The structure underlying the abstract structures is thus not known. Consequently, the truth or falsity of the representations by the abstract structures is not known. Thus, it is argued that the attributes of income are not measurable. Table 12.8 reflects the views of the chartered accountants on this statement.

Table 12.8: Statement 8

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	28	25.23	91.90
Agree	74	66.67	
Unsure	5	4.50	8.10
Disagree	4	3.60	
Strongly Disagree	0	0	
Total	111	100	100

It is clear from table 12.8 that 66.67 percent of chartered accountants agree with statement 8 and 25.23 percent strongly agree. In other words, 91.90 percent of chartered accountants are therefore in agreement with the statement. This suggests that the majority of chartered accountants are not aware that income has no measurable attributes under the current accounting conceptual framework. Its empirical relational structure cannot be specified. This means that the attributes of income that are measurable are not known. In chapter 2 it was noted that before measurement can take place it is necessary to specify the empirical

relational structure of the phenomenon to be measured. Therefore, it can be concluded that the majority of accountants is not aware that measurement cannot take place in the absence of a specified empirical relational structure.

Statement 9: *The attributes of expenses are measurable.* This statement is designed to test whether accountants believe that expenses have attributes that are currently measurable under the current accounting conceptual framework. Chambers (1997) notes that accounting literature has not specified the attributes that are of use and interest to measure in the accounting discipline. This suggests that expenses currently have no specified attributes that are of use and interest to measure. It was also established in chapter 6 that expenses do not have measurable attributes under the current accounting conceptual framework. This is because currently expenses do not have specified relational structures under the accounting conceptual framework. This means that the attributes of expenses that are measurable are not known. But, in chapter 2 the point was made that in a measurement space it is necessary to specify the empirical relational structure and the empirical attributes that are of use and interest to measure (Luce *et al.*, 1971). This suggests that expenses do not currently have specified measurement spaces under the IASB framework (2006) for financial reporting. Table 12.9 indicates the views of the chartered accountants.

Table 12.9: Statement 9

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	18	16.22	85.59
Agree	77	69.37	
Unsure	12	10.81	14.41
Disagree	3	2.70	
Strongly Disagree	1	0.90	
Total	111	100	100

The table demonstrates that 69.37 percent of chartered accountants agree with statement 9 and 16.22 percent strongly agree. Therefore, 85.59 percent of chartered accountants are in agreement with statement 9. This suggests that most chartered accountants are not aware that expenses have no specified attributes that are measurable under the current accounting conceptual framework. Consequently, it can be concluded that accountants are not aware that it is necessary to specify the attributes that are the subject of measurement before measurement can take place.

Statement 10: *It is possible to measure the attributes of future events.* This statement tests whether accountants believe that it is possible to measure a phenomenon that does not exist. It should be pointed out that all measurements are made at a point in time and the purpose of the measurement is to discover the magnitude at that point in time, without regard to what has gone before or what will come after that point (Sterling, 1979). This means that something that is in the future is not measurable in the present. Only the expectations of future events are measurable in the present. Orbach (1978) points out that, expectations have legitimate properties that are measurable in the present. Thus, it can be argued that the attributes of future events are not measurable in the present. Table 12.10 reflects the views of the chartered accountants.

Table 12.10: Statement 10

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	4	3.60	41.44
Agree	42	37.84	
Unsure	30	27.03	27.03
Disagree	32	28.83	31.53
Strongly Disagree	3	2.70	
Total	111	100	100

Table 12.10 reflects that 37.84 percent of chartered accountants agree with statement 10 and 3.60 percent of them strongly agree with it. A small percentage (27.03 percent) of the chartered accountants is not sure whether or not to agree with the statement. It should be noted that the respondents who agreed, disagreed and were unsure are classified as having responded positively to a statement that required a negative response. As a result, the analysis of the percentage responses classifies these responses as having responded in the same way. The table also indicates that a significant proportion of chartered accountants (31.53 %) is also aware that the attributes of future events are not measurable in the present. This reveals a debate in the accounting discipline on what is measurable and what is not. Nevertheless, it is clear that the proportion of accountants who are aware that phenomena that do not exist are not measurable is smaller than that which believes that non-existent phenomena are measurable. Therefore, it follows that the majority of chartered accountants are therefore not aware that it is not possible to measure a phenomenon that does not exist. It can therefore be concluded that accountants are not familiar with the principles of representational measurement that require (see, chapter 2) that the phenomena that are the subject of measurement must be empirically testable.

Discussion

The purpose of the statements in this section has been to establish whether accountants are aware that, under the current conceptual framework, accounting phenomena do not have measurable attributes. The concept of measurement is normally applied to an abstraction of facts from a given situation. Currently, the accounting conceptual framework requires that an element of the financial statement should have a cost or value that is measurable with reliability before it can be recognized in the financial statement. However, value is not currently measurable under the accounting conceptual framework. This means that the information about value that should be abstracted currently from the attributes of the elements of financial statements has no measurable attributes. As outlined earlier (Stevens, 1951), measurement is more immediately the goal of the

experimental corner where the patient sifting of facts and relations has disentangled some of the relevant variables. This means that the individuals doing the measurement must be able to identify the attributes that they are measuring.

In chapter 6 it was noted that there are no specified attributes of the elements of financial statements that are measurable. If this is the case, it can be inferred that the accounting discipline has not disentangled any relevant measurable variables of these elements of financial statements. This section tested whether accountants are aware that the elements of the financial statements do not have measurable attributes under the current IASB (2006) accounting conceptual framework for financial reporting. Chartered accountants are generally not aware that the elements of financial statements do not currently have measurable attributes under the present accounting conceptual framework. This suggests that chartered accountants are not familiar with the application of the principles of the representational theory of measurement.

Section 3: Measurement and the recognition of accounting phenomena

This section was designed to test whether accountants are aware that the rules for recognizing the elements of financial statements are not consistent with the principles of representational measurement. As was discussed in chapter 7, the rules for recognizing the elements of financial statements are not in harmony with the principles of representational measurement. The IASB framework (2006) for financial reporting points out that measurement of the value or cost of an item that meets the definition of an element is necessary for recognition of that item in the financial statement to occur. This viewpoint highlights that the measurement of cost or value is fundamental to the preparation of financial statements. It follows that without the measurement of cost or value no financial statements can be prepared. In chapter 7, it was noted that the accounting discipline has not yet recognized the distinction between the domain of the measurement function, the measurement function and the value of that measurement function. In particular,

cost is referred to in some instances as the domain of the measurement function and in others as its value. It was also noted in chapter 6 that value does not have attributes that are measurable. Value has not been precisely defined in the accounting literature. Luce *et al.* (1971) points out that it is necessary to define precisely an empirical relational structure before measurement can take place. This lack of a clear definition of the concepts of cost and value makes them immeasurable. In a measurement space, a precise knowledge of the objects of measurement is essential. Statements 11 to 15 test whether accountants are aware that the principles for recognizing the items that meet the definition of elements of financial statements are not in harmony with the principles of representational measurement.

Statement 11: *An item that meets the definition of an element of financial statements should be recognized if the item has a cost or value that can be measured with reliability.* This statement tests whether accountants believe that under the current IASB framework (2006) for financial reporting items that meet the definition of an element of the financial statement and that are recognized in the financial statement have a cost or value that can be measured with reliability. It was established in chapters 6 and 7 that the cost or the value of an element of a financial statement is not currently measurable under the accounting conceptual framework. If the principles of the representational theory of measurement were being followed under the IASB framework (2006) for financial reporting it would not be possible to recognize a single economic event in the financial statements since cost and value are not currently measurable.

Accountants are currently preparing financial statements (annual reports are published each year), but cost and value are currently not measurable. This raises the question of whether accountants are aware that they are currently recognizing items that meet the definition of an element of the financial statement, but these items do not have a cost or value that is currently measurable. Table 13.11 reflects the views of the chartered accountants on this statement.

Table 12.11: Statement 11

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	42	37.85	91
Agree	59	53.15	
Unsure	4	3.60	9
Disagree	4	3.60	
Strongly Disagree	2	1.8	
Total	111	100	100

Table 12.11 reflects that 53.15 percent of chartered accountants strongly agree with statement 11 while 37.84 percent agree with the statement. Therefore, 91 percent of chartered accountants are in agreement with the statement. This suggests that the majority of chartered accountants is not aware that the prescription by the IASB framework (2006) for financial reporting that an item that meets the definition of an element of financial statements should be recognized if the item has a cost or value that can be measured with reliability is currently false. Accountants are currently recognizing economic events that do not have a cost or value that is measurable. This indicates that accountants are not aware that cost and value are currently not measurable.

Statement 12: *Valuation is a process that is similar to measurement.* This statement is designed to test whether accountants believe that the process of valuation is similar to measurement. In chapter 6 it was established that the process of valuation is not a process of measurement. Goldberg (2001) points out that value reflects the personal desires of an individual. In other words, value is a subjective concept. This suggests that the processes of determining value are also subjective. In chapter 2 it was noted that the process of measurement must be an empirically verifiable process. This also implies that the process of valuation is not a process of measurement. Table 12.12 reflects the views of chartered accountants on statement 12.

Table 12.12: Statement 12

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	17	15.32	63.97
Agree	54	48.65	
Unsure	11	9.91	36.04
Disagree	23	20.72	
Strongly Disagree	6	5.41	
Total	111	100	100

In table 12.12 it is clear that 48.65 percent of chartered accountants agree with statement 12 and 15.32 percent of academic chartered accountants strongly agree. Therefore, 63.97 percent of chartered accountants – the majority – are not aware that valuation is a process that is not similar to measurement. This indicates that the majority of accountants cannot distinguish a process of valuation from a process of measurement. It can be inferred from this that the majority of accountants are not familiar with the process of measurement and that they are currently not performing the process of measurement in accounting.

Statement 13: *Value determinations continually refer to future states (Smith, 1956:116).* This statement tests whether accountants believe that value determination processes are focused on the future. It was established in chapter 6 that value determinations involve an estimation of future quantities. All measurements occur at a specific point in time and the purpose of the measurement is to discover the magnitude at that point in time, regardless of what has gone before or what will come after that point in time (Sterling, 1979). This indicates that measurement occurs only in the present. Goldberg (2001) points out that it is not possible to forecast with precision the future states of value. Value determinations are thus an attempt to predict the future and cannot therefore be empirically verified: they are dependent on assumptions that cannot be empirically verified. Consequently, value determinations are not processes of measurement. Table 12.13 reflects the views of chartered accountants on this statement.

Table 12.13: Statement 13

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	17	15.32	59.46
Agree	49	44.14	
Unsure	22	19.82	40.54
Disagree	19	17.12	
Strongly Disagree	4	3.60	
Total	111	100	100

From table 12.13 it is clear that 44.14 percent of chartered accountants agree with statement 13 and 15.32 percent strongly agree. It can be inferred that 59.46 percent of chartered accountants are therefore in agreement with statement 13. This suggests that the majority of academic accountants is aware that value is not a present-oriented phenomenon but a future-oriented phenomenon. However, a significant proportion {Unsure +Disagree + Strongly Disagree) of chartered accountants, that is 40.54 percent, is not aware that the processes of determining value are focused on the future. Sterling (1979) points out that processes that are focused on the future are forecasting processes. He argues that processes of forecasting lead to the production of forecasts and not to measurements. This suggests that a significant proportion of chartered accountants is aware that the process of determining value is a forecasting process.

Statement 14: *Historical cost basis, current cost basis, realisable value basis and the present value basis are theories of measuring value.* This statement tests whether accountants believe that the bases of accounting measurement, outlined in the accounting conceptual framework (IASB, 2006), that are employed in recognizing the items that meet the definition of an element of financial statements are theories of measurement. Orbach (1978), notes that historical cost and current cost are neither bases nor theories of measurement. It was established in chapter 6 that these bases of accounting measurement are not in harmony with the principles of the representational theory of measurement. Table 12.14 reflects the views of chartered accountants on this statement.

Table 12.14: Statement 14

Rating Scale	Frequency	Percentage	Analysis of percentages
Strongly Agree	27	24.32	92.79
Agree	76	68.47	
Unsure	1	0.90	7.21
Disagree	7	6.31	
Strongly Disagree	0	0	
Total	111	100	100

Table 12.14 reveals that 68.47 percent of chartered accountants agree with statement 14 while 24.32 percent strongly agree. The great majority (92.79 percent) of chartered accountants is therefore in agreement with statement 14. This suggests that the majority of chartered accountants are not aware that the bases of accounting measurement are not theories of measurement. It can therefore be concluded that accountants are not familiar with the principles of representational measurement and that they cannot establish whether or not a particular numerical assignment leads to measurement.

Statement 15: *The amount of monetary units paid to acquire a commodity is a measure of its value.* This statement tests whether accountants believe that the amount of monetary units assigned to a commodity or an element of the financial statement is a measure of its value. As has been noted earlier in this study (Ryan *et al.* 2002), the relationship between the amount of monetary units paid to acquire a commodity and its value is not known. Luce *et al.* (1971) point out that for measurement to occur the relationship between the empirical relational structure and the numerical relational structure must be known. Therefore, if the relationship between monetary units and value is not known, monetary units cannot be a measure of value. Table 12.15 reflects the views of the chartered accountants on statement 15.

Table 12.15: Statement 15

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	20	18.02	69.37
Agree	57	51.35	
Unsure	10	9.01	30.63
Disagree	20	18.02	
Strongly Disagree	4	3.60	
Total	111	100	100

Table 12.15 reflects that 51.35 percent of chartered accountants agree with statement 15 and 18.02 percent strongly agree. Therefore, 69.37 percent of chartered accountants are in agreement with statement 15. This suggests that the majority of chartered accountants is not aware that the amount of monetary units assigned to a commodity or an element of the financial statement is not a measure of its value. In chapter 6 it was mentioned that the relationship between the empirical relational structure and the numerical relational structure must be known for measurement to occur. This suggests that accountants are not familiar with the principles of measurement.

Discussion

The purpose of this section has been to establish whether accountants are aware that the principles for recognizing the elements of financial statements are not in harmony with the principles of the representational theory of measurement. Currently, the accounting conceptual framework (IASB, 2006) requires that an item that meets the definition of an element of financial statements should be recognized in the financial statements if it has a cost or value that can be measured with reliability. Yet there is no precise definition of the concept of value or cost. The responses to the statements in this section suggest that accountants are not aware that value or cost has no precise definition and, as a result, value or cost is not measurable.

It should be pointed out that the responses to this section indicate that accountants are not aware that the accounting principles of recognizing the elements of financial statements in financial statements are not in harmony with the principles of the representational theory of measurement.

Section 4: The integrity of accounting information created under the accounting conceptual framework

This section is designed to test whether accountants are aware that accounting measurement information is not empirically testable. All measurements must be objective. The concept of objectivity in measurement is linked to the concept of invariance. According to Stevens (1951), invariance is defined as changelessness in the midst of change, permanence in a world of flux, the persistence of configurations that remain the same despite the swirl and stress of countless hosts of curious transformations. Measurements must not change with the opinion of the observer. Measurements must mean the same thing irrespective of the change in circumstances. In representational measurement an empirical relational structure is represented by an abstract structure. In this case, the abstract structure must exhibit the same properties as the empirical relational structure. It follows that the statistical analysis of measurements must exhibit invariance appropriate to the structure underlying the measurements. In chapter 8 it was established that accounting measurement information is not objective. The statements in this section test whether accountants are aware that accounting measurement information is not objective.

Statement 16: *Future events do not represent reality.* This statement is designed to test whether accountants are aware that the attributes of future events do not represent reality and are therefore not measurable. Sterling (1979) points out that measurement occurs in the present and that the attributes of future events are not measurable. It was also established in chapter 5 that the attributes of future events are not measurable. It is only the expectations of the attributes of future

events that have legitimate properties in the present that are measurable. Table 12.16 reflects the views of chartered accountants on statement 16.

Table 12.16: Statement 16

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	11	10.09	44.77
Agree	38	34.86	
Unsure	24	22.02	57.69
Disagree	32	29.36	
Strongly Disagree	4	3.67	
Total	109	100	100

Frequency missing = 2

It is clear from the table 12.16 that 32 percent of chartered accountants disagree with statement 16 and 22.02 percent are not sure whether to agree or disagree with the statement. A small percentage (3.67 percent) strongly agrees with the statement. It follows that 57.69 percent of chartered accountants are not aware that the attributes of future events do not represent reality and are therefore not measurable. It follows that the majority of accountants are unaware of what is measurable and what is not in accounting. This suggests that the majority of accountants are not familiar with the principles of representational measurement. The table also reveals that 44.77 percent of chartered accountants agree with statement 16. This highlights the point that a significant proportion of chartered accountants are aware that future events have not happened yet and as a result they do not represent reality. In chapter 2 it was noted that it is only the attributes of empirical phenomena that are measurable. It follows, then, that a significant proportion of chartered accountants is aware that the attributes of future events are not empirical and are therefore not measurable.

Statement 17: *Estimates in accounting reflect measurements of the attributes of economic transactions.* This statement tests whether accountants believe that

estimates are measurements. As was established in chapter 5, estimates are not measurements, although the accounting literature classifies them as such. In chapter 2 it was noted that all measurements must be capable of being empirically verified. Sterling (1979) also points out that estimates are not measurements. This is because estimates are not empirically verifiable. However, the IASB framework (2006) for financial reporting refers to estimates as measurements. This indicates that the principles that guide financial reporting hold that estimates and measurements are identical. This statement tests whether accountants are aware that estimates are incorrectly referred to as measurements in the accounting discipline. Table 12.17 reflects the views of the chartered accountants.

Table 12.17: Statement 17

Rating Scale	Frequency	Percentage %	Analysis of percentages%
Strongly Agree	8	7.21	74.78
Agree	75	67.57	
Unsure	20	18.02	25.23
Disagree	8	7.21	
Strongly Disagree	0	0	
Total	111	100	100

The table above indicates that 67.57 percent of chartered accountants agree with statement 17 and 7.21 percent strongly agree. That is, 74.78 percent of academic chartered accountants are in agreement with the statement. This suggests that chartered accountants are not aware that estimates are not measurements. It can be inferred from this that the majority of accountants are not able to distinguish between the processes that give rise to measurements and those that do not. Therefore, it can be concluded that accountants are not familiar with the principles of measurement.

Statement 18: *Accrual accounting is mainly concerned with the measurement of the attributes of future accounting phenomena.* This statement tests whether

accountants believe that the attributes of future accounting phenomena are currently being measured under the accrual concept. According to Goldberg (2001:95), the cash basis of accounting does not portray an accurate measure of net financial results from periodical business activity. The accrual notion is applied as a remedy by bringing to account in a given period any deferred or expected elements of revenue or outlay which could be rationally viewed as appropriate to the period under review, even though the cash impact would be felt in some other period. This highlights the point that the notion of accrual is focused on the quantification of future happenings that are expected to have an impact on the current accounting period. Accrual accounting is thus concerned with the measurement of the current effects of future phenomena. Sterling (1979) points out that all measurements are made at a point in time regardless of what has happened before or of what happens after that point. This suggests that the accrual concept of accounting measurement is not measurement after all, nor is it in harmony with the principles of representational measurement. Table 12.18 reflects the views of the chartered accountants on this statement.

Table 12.18: Statement 18

Rating Scale	Frequency	Percentage %	Analysis of percentages%
Strongly Agree	5	4.50	30.63
Agree	29	26.13	
Unsure	17	15.32	69.38
Disagree	52	46.85	
Strongly Disagree	8	7.21	
Total	111	100	100

The table above reflects that 46.85 percent of chartered accountants disagree with statement 18 while 7.21 percent of chartered accountants strongly disagree with it. Furthermore, 15.32 percent of accountants are not sure whether or not to agree with this statement. Therefore, it follows that 69.38 percent of the chartered accountants are in disagreement with statement 18. This suggests that the majority of chartered accountants are not aware that the concepts of accrual

accounting are not consistent with the principles of the representational theory of measurement.

Statement 19: *Income is an ambiguous concept that is not an intrinsic property of an accounting entity (Stamp, 1981).* This statement tests whether accountants are aware that the qualitative structure of income cannot be empirically verified. As was established in chapter 6, the concept of income is dependent on the opinion of the individual. Luce *et al.* (1971) point out that objects of measurement must be empirically testable. Consequently, this means that income is not measurable. Only empirically verifiable phenomena are measurable. Table 12.19 indicates the views of chartered accountants about this statement.

Table 12.19: Statement 19

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	7	6.31	18.92
Agree	14	12.61	
Unsure	23	20.72	81.08
Disagree	59	53.15	
Strongly Disagree	8	7.21	
Total	111	100	100

The table reflects that 53.15 percent of chartered accountants disagree with statement 19 and 7.21 percent strongly disagree with it. Furthermore, 20.72 percent of chartered accountants are unsure about whether or not statement 19 is true. In other words, 81.08 percent of chartered accountants are in disagreement with the statement. Therefore, the majority of chartered accountants are not aware that income is an ambiguous concept that is not an intrinsic property of an accounting entity. This suggests that accountants are not aware that income is not measurable.

Statement 20: *Value is an ambiguous concept and it is not an intrinsic property of an accounting entity (Stamp, 1981).* This statement tests whether accountants are

aware that value is not an empirical property of an accounting entity. In chapter 6 it was noted that the concept of value lacks a precise definition, and as a result it cannot be considered to be a measurable property of an accounting entity. It follows that accounting information about value cannot be considered to be verifiable empirical information. In chapter 2 it was established that only empirical phenomena are measurable. This means that accounting value is not measurable. Table 12.20 reflects the views of chartered accountants on statement 20.

Table 12.20: Statement 20

Rating Scale	Frequency	Percentage %	Analysis of percentages%
Strongly Agree	12	10.81	39.64
Agree	32	28.83	
Unsure	19	17.12	60.44
Disagree	44	39.64	
Strongly Disagree	4	3.60	
Total	111	100	100

The table shows that 39.64 percent of chartered accountants disagree with statement 20 and 3.60 percent of the chartered accountants strongly disagree with it. A small percentage (17.12 percent) is not sure whether or not to disagree with the statement. In total, 60.44 percent of chartered accountants are in disagreement with the statement. It is also clear from the table that 39.64 % of respondents are in agreement with the statement. This proportion can be considered to be significant in relation to the overall study. It can be inferred from this that there is an ongoing debate in accounting on whether or not value is empirical. However, the overall response suggests that accountants are not aware that value is an ambiguous concept and not an intrinsic property of an accounting

entity (phenomenon). It follows that the majority of accountants are not aware that value is not measurable.

Statement 21: *The attributes of accounting phenomena are dependent on the judgement of the accountant.* This statement tests whether accountants are aware that the attributes of accounting phenomena that are of use and interest to measure under the accounting conceptual framework cannot be objectively determined. It was established in chapter 7 that the existence of the attributes of accounting phenomena that are of interest to measure in accounting depends on the intuition of the accountant. The accounting framework (IASB, 2006) specifies the attributes of accounting phenomena that are of use and interest to measure as value or cost. In chapter 6 it was noted that value is ambiguous and does not have a precise definition. In chapter 7 it was established that the concept of cost is not precisely defined. This indicates that both cost and value are ambiguous and cannot be precisely identified. Table 12.21 reflects the views of chartered accountants on statement 21.

Table 12.21: Statement 21

Rating Scale	Frequency	Percentage %	Analysis of percentages%
Strongly Agree	8	7.21	57.66
Agree	56	50.45	
Unsure	10	9.01	42.34
Disagree	35	31.53	
Strongly Disagree	2	1.80	
Total	111	100	100

The table reflects that 50.45 percent of chartered accountants agree with statement 21 while 7.21 percent strongly agree. A total of 57.66 percent of chartered accountants are therefore in agreement with the statement. This figure suggests that the majority of accountants are aware that the attributes of accounting phenomena cannot be objectively determined. The table also indicates

that 42.34 percent of chartered accountants are not in agreement with statement 21. This indicates that a significant proportion of chartered accountants are not aware that the characteristics of accounting phenomena are dependent on the opinion of the accountant. It follows that a significant proportion of chartered accountants is not familiar with the characteristics of the objects of measurement in accounting. It can therefore be concluded that a significant proportion of accountants should be educated about the principles of measurement.

Statement 22: *Value is whatever two people are willing to trade for.* This statement is designed to test whether accountants are aware that the concept of value is unique to a specific economic transaction. Tinker (1985) points out that value is socially constructed. This suggests that value is dependent on specific circumstances of an economic transaction. In chapter 6 it was established that value cannot be empirically verified. As a result, the concept of value cannot be common to all economic transactions. Table 12.22 reflects the responses of chartered accountants to this statement.

Table 12.22: Statement 22

Rating Scale	Frequency	Percentage %	Analysis of percentages%
Strongly Agree	24	21.62	61.26
Agree	44	39.64	
Unsure	9	8.11	38.74
Disagree	33	29.73	
Strongly Disagree	1	0.90	
Total	111	100	100

The table reveals that 39.64 percent of chartered accountants agree with statement 22 while 21.62 percent strongly agree with it. More than half (61.26 percent) of chartered accountants are therefore in agreement with the statement. This suggests that accountants are aware that value is dependent on particular circumstances and is therefore subjective.

Discussion

This section was designed to test whether accountants are aware that accounting information in financial statements is not objective. The phenomena that this information is meant to describe are subjective. In measurement literature the properties of the empirical relational structure that are described by measurement information are supposed to be empirically testable. The responses of the accountants in this section reveal that they are not aware that measurement information represents objectively existing entities. Their responses also indicate that they are not aware that the phenomena that are commonly referred to as capable of being measured (e.g., income, value) in the accounting literature are in fact not objectively determinable phenomena. It can further be inferred from these responses that accountants are not aware of the difference between estimates and measurements. This discussion indicates that accountants do not have adequate knowledge about the principles of measurement. As a result, they are not aware of the difference between measurements and quantifications that are not measurements. Their lack of measurement knowledge makes accountants uncertain as to whether or not accounting is a measurement discipline.

Section 5: Measurement and the concept of time under the accounting conceptual framework

This section tests whether accountants are aware that the concept of time in accounting distinguishes between measurements and numerical quantifications that are not measurements. All measurements are made at a specific point in time. It has been established in this study (Sterling, 1968) that the purpose of a measurement is to discover the magnitude at a point in time without regard to what has gone before or what will come after that point. This suggests that measurement only occurs in the present.

The IASB framework (2006) for financial reporting points out that financial statements are usually prepared on the assumption that an entity is a going concern and will continue in operation for the foreseeable future. For this reason it

is assumed that the firm has neither the intention nor the need to liquidate or curtail materially the scale of its operations. If such an intention or need exists the financial statements may be prepared on a different basis and that basis has to be disclosed (IASB, 2006). It can be inferred from this that, currently, accounting measurement usually takes place under going concern. It follows that when accountants talk about accounting measurement, they are referring to measurement under the going concern assumption. If however, as outlined above, all measurements are made at a specific point in time, then it is not possible for measurement to take place under the going concern assumption. Sterling (1968) points out that the statements prepared under the going concern concept are provisional; it requires the liquidation case before final accurate statements can be prepared. This suggests that financial statements prepared under going concern do not represent measurement information.

It was also established in chapter 5 and chapter 9 that the way financial statements are prepared under the going concern assumption is not compatible with the principles of the representational theory of measurement. This section tests whether accountants are aware that measurement is not possible under the going concern assumption.

Statement 23: *The going concern assumption is necessary for accounting measurement to occur.* This statement tests whether accountants believe that the going concern assumption is necessary for accounting measurement. As has been established in chapter 5, the going concern assumption continually refers to future states. Sterling (1968) points out that the statements prepared under going concern are dependent on subsequent events for their confirmation. This means that all accounting magnitudes under the going concern are dependent on subsequent events for their empirical testability. Sterling (1979) also highlights that the purpose of measurement is to discover the magnitude at that point in time without regard to what has gone before or what will come afterwards. This indicates that measurement cannot occur under going concern. Table 12.23 reflects the views of the chartered accountants on this statement.

Table 12.23: Statement 23

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	23	20.72	58.56
Agree	42	37.84	
Unsure	8	7.21	41.44
Disagree	29	26.13	
Strongly Disagree	9	8.11	
Total	111	100	100

The table indicates that 37.84 percent of chartered accountants agree with statement 23 and 20.72 percent strongly agree with it. Therefore, 58.56 percent of chartered accountants are not aware that no accounting measurement occurs under the going concern assumption. Consequently, it follows that the majority of accountants are not aware that the going concern assumption is not necessary for accounting measurement to occur.

The table also indicates that 41.44 percent of chartered accountants do not agree with statement 23. This indicates that a significant proportion of chartered accountants do not believe that the going concern assumption is necessary for accounting measurement to occur. It follows then that a significant proportion of chartered accountants is aware that no measurement occurs under going concern.

Statement 24: *It is possible to measure periodic income under the going concern assumption.* This statement tests whether accountants believe that income is measurable under going concern. Sterling (1968), notes that the income from a business is not measurable during its lifetime, except at liquidation. This means that measures of periodic income are provisional. Sterling (1979) adds that all measurements are made at a specific point in time. This suggests that no phenomenon is measurable under going concern, as statements made under going concern are dependent on subsequent events. Income always lies in the future under the going concern assumption. Goldberg (2001) points out that

accounting events flow through a business during its lifetime. This means that in order to measure periodic income during the lifetime of a business, business has to be stopped so that the income can be measured. But, if business activities were stopped in order to measure income, the concept of flowing activities would not be true. Table 12.24 reflects the views of chartered accountants on this issue.

Table 12.24: Statement 24

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	12	10.81	82.88
Agree	80	72.07	
Unsure	15	13.51	17.11
Disagree	4	3.60	
Strongly Disagree	0	0	
Total	111	100	100

The table above indicates that 72.07 percent of chartered accountants agree with statement 24 and 10.81 percent strongly agree: 82.88 percent of chartered accountants are therefore in agreement with the statement. This suggests that chartered accountants are not aware that periodic income is not currently measurable under the going concern assumption. In chapter 6 it was noted that periodic income is not measurable. Therefore, it can be concluded that the majority of chartered are not aware that periodic income is not measurable.

Statement 25: *Under the going concern assumption the statement of financial position reflects true measurements of the attributes of assets and liabilities.* This statement tests whether accountants believe that the balance sheet reflects measurements of the attributes of assets and liabilities. Willet (1987) notes that no property is currently being measured in the accounting discipline apart from the numerosity of monetary units. He argues that it is not known exactly what the monetary units represent in accounting. This indicates that it is not known what

aspect of assets and liabilities the monetary units represent. Ryan *et al.* (2002) also point out that the relationship between value and monetary units is not known with certainty. This means that monetary units cannot be considered invariant in terms of the underlying structure of value. Consequently, a balance sheet cannot contain measurements of the attributes of assets and liabilities. Table 12.25 reflects the views of the chartered accountants on this statement.

Table 12.25: Statement 25

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	13	11.71	62.16
Agree	56	50.45	
Unsure	12	10.81	37.84
Disagree	28	25.23	
Strongly Disagree	2	1.80	
Total	111	100	100

The table reveals that 50.45 percent of chartered accountants agree with statement 25 and 11.71 percent strongly agree with it. It follows that 62.16 percent of chartered accountants are in agreement with the statement. Therefore, the majority of chartered accountants are not aware that the balance sheet does not contain measurements of the attributes of assets and liabilities. In chapter 6 it was established that value is currently not measurable in the accounting discipline. Consequently, it can be inferred from this that accountants are not aware that value is currently not measurable in accounting.

Statement 26: *The valuation of assets and liabilities can only occur under the going concern assumption.* This statement tests whether accountants are aware that the valuation of assets and liabilities can only occur under the going concern assumption. Smith (1956) notes that value determinations continually refer to future states. This means that the present concept of value is dependent on subsequent events. Sterling (1979) also points out that subsequent events always

lie in the future. This suggests that subsequent events can never be known. The going concern assumption is necessary for the future benefit theory in the valuation of assets and liabilities. Assets are values in terms of the expected future economic benefits that flow into or out of the firm respectively. This means that the firm has to exist in the future in order to receive the benefits. Table 12.26 reflects the views of chartered accountants.

Table 12.26: Statement 26

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	3	2.70	27.03
Agree	19	17.12	
Unsure	8	7.21	
Disagree	60	54.05	72.97
Strongly Disagree	21	18.92	
Total	111	100	100

It is evident from this table that 54.05 percent of chartered accountants disagree with statement 26 while 18.92 percent strongly disagree. In other words, 72.97 percent of chartered accountants disagree with statement 26. This suggests that chartered accountants are not aware that the valuation of assets and liabilities can only occur under the going concern assumption. It follows that accountants are not aware of the importance to accounting of the going concern assumption. In chapter 5 it was established that the preparation of financial statements for a company that is expected to continue for the foreseeable future should be prepared under going concern. This would not be possible without the going concern assumption.

Statement 27: *The values of assets can be meaningfully added to each other in the balance sheet.* This statement tests whether accountants believe that the values of assets can be meaningfully added to each other in the balance sheet. The IASB framework (2006) for financial reporting indicates that an item that

meets the definition of an element of the financial statements should be recognized in the financial statement if it has a value that can be measured with reliability in monetary terms. This means that assets and liabilities that are recognized in the balance sheet are believed to have a cost or value that is measurable. As noted in chapter 6, value is an ambiguous concept, and as a result is not currently measurable. But, according to Stevens (1951), all phenomena that are measurable must be empirical. This suggests that value cannot be empirically verified. This means that the monetary units used to represent the values of assets and liabilities are not measures of value. Willet (1987) claims that it is not known exactly what monetary units represent in accounting. It can be inferred from this that monetary units are related to value by unknown psychological laws. Measurements can only be added to each other if it can be shown that they are not structurally different. Therefore, if the relationship between value and monetary units is not known, it is not possible to determine whether monetary units representing the values of different assets are structurally identical. Table 12.27 reflects the views of chartered accountants on this statement.

Table 12.27: Statement 27

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	10	9.01	68.47
Agree	66	59.46	
Unsure	12	10.81	31.53
Disagree	18	16.22	
Strongly Disagree	5	4.50	
Total	111	100	100

The table above indicates that 59.46 percent of chartered accountants agree with statement 27 and 9.01percent strongly agree. Therefore well over half (68.47 percent) of chartered accountants are in agreement with the statement. This

suggests that the majority of chartered accountants are not aware that the values of assets can be meaningfully added to each other in the balance sheet. This also indicates that accountants are not familiar with the principles of representational measurement.

Statement 28: *The values of the items of income in the income statement can be meaningfully added to and subtracted from each other.* This statement tests whether accountants believe that the values of the items of income in the income statement can be meaningfully added to and subtracted from each other. Ryan *et al.* (2002) point out that the relationship between value and monetary units is not known with certainty. This means that it is not known how monetary units are assigned to the units of value. It follows that it is not known whether the rules of assigning monetary units to the values of the items of income are identical. Luce (1996) believes that measurements can only be added to each other if it can be shown that they are not structurally different. This means it is not possible to determine whether monetary units representing the values of different items of income in the income statement are structurally identical. Table 12.28 reflects the responses of the chartered accountants.

Table 12.28: Statement 28

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	13	11.71	70.27
Agree	65	58.56	
Unsure	12	10.81	29.73
Disagree	17	15.32	
Strongly Disagree	4	3.60	
Total	111	100	100

This table shows that 58.56 percent of chartered accountants agree with statement 28 and 11.71 percent strongly agree. In other words, 70.27 percent of chartered accountants are in agreement with the statement. This suggests that

chartered accountants are not aware that that the values of items of income in the income statement cannot be meaningfully added to and subtracted from each other. In chapter 2 it was outlined that measurements that are not identical should not be added to or subtracted from each other. These results suggest that accountants are not familiar with the principles of representational measurement.

Statement 29: *The income generated by cash sales and credit sales can be meaningfully added to each other.* This statement tests whether accountants believe that the income generated by cash sales and credit sales can be meaningfully added to each other. These quantifications are not structurally identical. According to Sterling (1979), all measurements are made at a specific point in time. He argues that the purpose of measurement is to discover the magnitude at that point in time, without regard to what has gone before or what will come after that point. In cash sales the relationship between monetary units received for a commodity and the value of a commodity sold is determined without regard to future time periods, by taking into account the present time variables. In credit sales the relationship between the cash that will be received in future for a commodity sold and the value of a commodity sold takes into account future time periods. This indicates that the two relationships are structurally different and consequently the income generated from credit sales and cash sales cannot be added. Furthermore, Ryan *et al.* (2002) point out that the relationship between monetary units and value is not known. This suggests that it is not possible to determine whether the assignment of monetary units to the value of commodities sold on credit is structurally identical to the assignment of monetary units to commodities sold for cash. Table 12.29 reflects the responses of chartered accountants to this statement.



Table 12.29: Statement 29

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	25	22.52	79.28
Agree	63	56.76	
Unsure	10	9.01	19.82
Disagree	11	9.91	
Strongly Disagree	2	1.80	
Total	111	100	100

From table 12.29 it is clear that 22.52 percent of chartered accountants strongly agree with the statement while 56.76 percent agree: 79.28 percent of chartered accountants are therefore in agreement with the statement. This suggests that chartered accountants are not aware that the income generated by cash sales and credit sales cannot be meaningfully added. This also indicates that accountants are not aware that income generated by cash sales and credit sales is structurally different and cannot be added together. It can therefore be concluded that accountants are not familiar with the principles of representational measurement.

Discussion

This section was designed to test whether accountants are aware that measurements are made at a specific point in time. It has been established in this section that accountants are not aware that measurement occurs at a specific point in time. Furthermore, it is not possible to achieve measurement in the accounting discipline under the going concern concept. All the statements prepared under the going concern assumption are provisional because they are dependent on subsequent events. According to Sterling (1968), subsequent events always lie in the future and can never be known. He also argues that measurement is the discovery of an extant position that requires a present act. Therefore, the dependence of the financial statements prepared under the going

concern assumption on subsequent events means that measurement cannot occur under the going concern assumption. It has also been noted that accountants are not aware that quantifications that represent different attributes of accounting phenomena cannot be added to each other. Moreover, accountants are unaware that quantifications made at different points in time and that represent both identical and different attributes of accounting phenomena cannot be added to each other in financial statements. As outlined earlier, measurements are made at a specific point in time: these quantifications are thus structurally different.

Section 6: The principles of representational measurement

This section is designed to test whether accountants are familiar with the principles of the representational theory of measurement. If accounting is a measurement discipline, as outlined in the accounting literature (IASB, 2006), then accountants who perform the process of measuring the attributes must be familiar with the principles of representational measurement in order to produce accounting measurement information that is in harmony with the principles of representational measurement. Furthermore, Mattessich (1964) notes that accounting measurements are measurements by fiat. He argues that they depend on the intuition of the accountant. If this is the case, it follows that accountants must be familiar with the principles of the representational theory of measurement in order to perform the act of measurement.

Statement 30: *Measurement refers to any method of assigning numbers to represent properties or qualities, according to some set of rules (Larson, 1969).*

This definition reflects the relative nature of measurement. It can be inferred from the statement that the process of measurement is defined by the choice of a method of measurement that is used to assign a number to represent a property of a phenomenon in a way that is governed by a consistent set of rules. According to Stevens (1951), numerals can be assigned under different sets of rules, leading to different kinds of scales and different kinds of measurement. This

means that there may be different ways of mapping an empirical relational structure onto an abstract structure. It follows that there is no restriction to the methods that can be chosen in the measurement process. In essence, representational measurement consists in specifying homomorphisms of some qualitative (or empirical) structure onto a numerical one (Narens, 1985). This means that there may be many measurement procedures that can be used for an identical attribute. This statement tests whether accountants are familiar with the definition of representational measurement. Table 12.30 reflects the responses of chartered accountants to this statement.

Table 12.30: Statement 30

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	10	9.01	83.78
Agree	83	74.77	
Unsure	9	8.11	16.21
Disagree	4	3.60	
Strongly Disagree	5	4.50	
Total	111	100	100

The table reflects that 74.77 percent of chartered accountants agree with statement 30 and 9.01 percent strongly agree: 83.78 percent of chartered accountants are therefore in agreement with the statement. This suggests that the majority of chartered accountants believes that the process of measurement is defined by the choice of a method of assigning numbers to represent a property using a consistent set of rules of assignment. It can therefore be concluded that it is reasonable to expect that accountants should be able to distinguish numerical assignments that lead to measurement from those that do not.

Statement 31: *Measurement is a relative matter (it varies in kind, degree, type and precision) (Stevens, 1951).* This statement reflects that measurements must be evaluated with respect to a specific frame of reference. This is one of the

fundamental principles of measurement. Decoene *et al.* (1995) point out that representational measurement equates measurement to numerical coding. This means that measurements made in different environments can be expressed in different ways. Consequently, measurements that are made in different environments should not be compared unless they have been adjusted to common circumstances. Stevens (1951) points out that measurement is relative to the configurations of the environment in which it is performed. This means that the conditions of the comparability of measurements must be specified before measurements can be compared. This statement tests whether accountants are aware that measurement is relative. Table 12.31 reflects the views of the chartered accountants on this statement.

Table 12.31: Statement 31

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	24	21.62	86.48
Agree	72	64.86	
Unsure	7	6.31	13.52
Disagree	8	7.21	
Strongly Disagree	0	0	
Total	111	100	100

The responses to statement 31 reflect that 64.86 percent of chartered accountants agree with statement 31 and 21.62 percent strongly agree with it. In other words, 86.48 percent of chartered accountants are in agreement with statement 31. This suggests that the majority of chartered accountants is aware that measurement is relative and that measurements from different social settings should not be compared unless they have been converted to a common scale of measurement. It can be concluded that accountants are aware that accounting measurement from different social settings should not be compared.

Statement 32: *Every measurement system requires the specification of a scale of some kind (Chambers, 1997).* A scale refers to a rule of measurement. According to Kaplan (1964:177), a rule of measurement defines both the magnitude and the measure. This means that no measurement can occur in the absence of a scale. Chambers (1997), notes that there are no specified scales of measurement in accounting. This suggests that the magnitudes and measures of accounting phenomena are not properly defined in the accounting discipline. This statement tests whether accountants are aware that the specification of a scale of measurement is fundamental to every measurement process. Table 12.32 reflects the responses of the chartered accountants to this statement.

Table 12.32: Statement 32

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	23	20.72	89.19
Agree	76	68.47	
Unsure	10	9.01	10.81
Disagree	2	1.80	
Strongly Disagree	0	0	
Total	111	100	100

The table reveals that 68.47 percent of chartered accountants agree with statement 32 while 20.72 percent strongly agree. That means that 89.19 percent of chartered accountants are in agreement with the statement. This suggests that the majority of chartered accountants is aware of the significance of a scale in a measurement discipline. In chapter 6 it was noted that the object of measurement in accounting is value, and that currently there is no scale of measuring value in accounting. It can therefore be concluded that accountants should be able to understand the significance of the concept of a scale in the measurement of value in accounting.

Statement 33: *An empirically true value of a measured quantity does not exist (Margenau, 1959).* In measurement literature, measurement is never any more than an approximation. According to Margenau (1959), what passes for truth in the results of measurement is maximum likelihood. This means that there are no true values of measured quantities. Larson (1969) believes that the accounting discipline overlooks the approximating nature of measurement. The accounting discipline uses terminology that implies exactness that is inconsistent with the approximating character of measurement. In chapter 3 it was established that the accounting concept of measurement does not take into account the concept of error. This statement tests whether accountants are aware of the existence of the concept of error in measurement. Table 12.33 indicates that the views of the chartered accountants on this statement.

Table 12.33: Statement 33

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	9	8.18	23.63
Agree	17	15.45	
Unsure	38	34.55	76.36
Disagree	39	35.45	
Strongly Disagree	7	6.36	
Total	111	100	100

From table 12.33 it is clear that 35.45 percent of chartered accountants disagree and 6.36 percent strongly disagree with statement 33. On the other hand, 34.55 percent of chartered accountants are not sure whether or not to agree with the statement. Therefore, 76.36 percent of chartered accountants are not aware of the concept of error in measurement. The survey indicates that the majority accountants are not aware of the concept of error in measurement. It follows that accountants are not able to tell that accounting measurements are not an exact representation of the properties of accounting phenomena.

Statement 34: *Measurement requires the specification of a property to be measured (Chambers, 1997).* The concept of measurement requires the precise specification of the property to be measured. Caws (1959) notes that measurement presupposes something to be measured, and, unless that something is known, no measurement can have any significance. This implies that if accounting is truly a measurement discipline it must have specified attributes that are of use and interest to measure. However, Chambers (1997) makes the point that the properties that are of use and interest to measure in the accounting discipline are not specified. This suggests that accountants are not aware that it is necessary to specify the property to be measured before measurement can occur (see chapter 2). This statement tests whether accountants are aware that it is not possible to produce a meaningful measure of an unknown entity. Table 12.34 below reflects the views of chartered accountants.

Table 12.34: Statement 34

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	14	12.61	87.38
Agree	83	74.77	
Unsure	10	9.01	12.61
Disagree	4	3.60	
Strongly Disagree	0	0	
Total	111	100	100

The table reveals that 74.77 percent of chartered accountants agree with statement 34 while 12.61 percent strongly agree with it. In total, 87.38 percent of chartered accountants are therefore in agreement with the statement. This suggests that chartered accountants are aware that it is not possible to measure an unknown entity. It can therefore be concluded that accountants are aware that numbers can only be assigned to an entity that can be empirically tested. It was noted in chapter 6 that the properties of value that are currently being measured

in accounting are not specified. It follows that accountants should specify the properties of value that they are currently measuring in accounting.

Statement 35: *Every measurement system requires the specification of a unit in the scale (e.g., Rands, kilograms, etc.) (Luce et al., 1990).* The number assigned to a phenomenon is unique once a scale of measurement has been assigned to it. Churchman and Ratoosh (1959) point out 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. This means that a number assigned to a phenomenon is meaningless unless a particular representation is specified. In chapter 1 it was pointed out that the object of measurement in accounting is value. Chambers (1997), notes that in the accounting discipline there are no specified scales for measuring value. This suggests that accountants are not aware of the importance of scales of measurement. This statement tests whether accountants are aware that it is necessary to specify the unit in the scale of measurement. Table 12.35 indicates the views of the chartered accountants.

Table 12.35: Statement 35

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	26	23.42	89.19
Agree	73	65.77	
Unsure	5	4.50	9.91
Disagree	6	5.41	
Strongly Disagree	1	0.90	
Total	111	100	100

The table above indicates that 65.77 percent of chartered accountants strongly agree with statement 35 and 23.42 percent strongly agree: 89.19 percent of chartered accountants are therefore in agreement with the statement. The survey indicates that the majority of chartered accountants are aware that it is necessary

to specify the unit in the scale of measurement. In chapter 2 it was noted that measurement cannot occur in the absence of a scale. It can therefore be concluded that the majority of accountants are aware of the importance of a scale in measurement.

Statement 36: *Measurement should take place under specified conditions.* This tests whether accountants are aware that measurements are made with respect to a specific context. It has been established in this study that measurement is relative to a chosen unit. Boyce *et al.* (1994:3) point out that measurement is not meaningful outside a community of discussion unless there is the existence and use of an official standard which has a high degree of acceptance. This means that measurements may be taken in a variety of non-standard situations, such that the raw or crude are not comparable. There is a need to specify the context of the meaningfulness of a measurement. Such a specification enhances the comparability of measures. Table 12.36 indicates the views of chartered accountants on this statement.

Table 12.36: Statement 36

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	19	17.27	84.48
Agree	74	67.21	
Unsure	12	10.91	15.46
Disagree	5	4.55	
Strongly Disagree	0	0	
Total	11	100	100

The responses to statement 36 indicate that 67.21 percent of chartered accountants agree with statement 36 and 17.27 percent strongly agree. In total, 84.48 percent of chartered accountants are therefore in agreement with the statement. This suggests that the majority of chartered accountants are aware that measurement should take place under specified conditions. It can therefore

be concluded that the majority of accountants are aware that measurements are relative to a specific frame of reference.

Question 37: *In a measurement discipline, the property to which numbers will be assigned must be measurable.* A property is measurable if it is capable of being represented by an abstract structure, such as natural numbers. The representations made by the abstract structure must also be meaningful. According to Luce *et al.* (1990), an assertion is meaningless if the attempt to express it in terms of the empirical relational structure shows it to be ambiguous. This means that the underlying empirical relational structure must be capable of being defined absolutely by the abstract structure. It has been established in this study that the qualitative structures of accounting phenomena are ambiguous and consequently not measurable. This statement tests whether accountants are aware that in a measurement discipline, the property to which numbers will be assigned must be measurable. Table 12.37 reflects the views of chartered accountants.

Table 12.37: Statement 37

Rating Scale	Frequency	Percentage %	Analysis of percentages
Strongly Agree	17	15.32	86.48
Agree	79	71.17	
Unsure	14	12.61	13.51
Disagree	1	0.90	
Strongly Disagree	0	0	
Total	111	100	100

The table reflects that 71.17 percent of chartered accountants agree with statement 37 and 15.32 percent strongly agree with it. In other words, 86.49 percent of chartered accountants are therefore in agreement with statement 37. This suggests that the majority of chartered accountants are aware that a property

to which numbers are assigned must be measurable. In chapter 2 it was noted that a property is measurable if it is empirically testable and if it can be represented by an abstract structure in a way that is empirically testable. It can therefore be concluded that the majority of chartered accountants are familiar with the representation measurement principle which states that in a process of measurement the property to which numbers will be assigned must be measurable.

Discussion

This section tested whether accountants are familiar with some of the basic principles of the representational theory of measurement. The responses in this section generally suggest that the majority of accountants are familiar with these principles. However, the responses also indicate that the majority of accountants are not familiar with the concept of error in measurement. Accountants are not aware that there are no exact measurements and that all measurements have an error of some sort. On the other hand, this suggests that the majority of accountants are not familiar with all the principles of measurement. As a result, the accounting concept of measurement implies an exactness that is not consistent with the principles of the representational theory of measurement.

12.3 Conclusion

A questionnaire with 37 statements, formulated in terms of information gleaned from the literature review in chapters 2 to 10, was distributed to chartered accountants. The significant issues flowing from the questionnaires were firstly that accountants, in the majority of cases (Section 1), believe that accounting is a measurement discipline and that accounting information is meaningful. But, as was established in chapters 2 to 10, the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement.

In section 2 it was revealed that the majority of accountants believe that the elements of financial statements have measurable attributes under the current principles of the accounting conceptual framework (IASB, 2006). But it was

established in chapters 2 to 10 that under the current accounting conceptual framework, the elements of financial statements do not have measurable attributes. The attribute of the elements of financial statements that is supposed to be measurable is value. However, in chapter 6 it was established that the value of an element of the financial statement is not measurable. In chapter 2 it was noted that the representational theory of measurement focuses only on those relations that the experimenter wishes to represent with an abstract structure. In this case, the relations among the attributes (values) of the elements of financial statements that accountants wish to represent with an abstract structure (monetary units) are not currently capable of being represented by an abstract structure.

In section 3, the responses to the questionnaire indicate that the majority of accountants are not aware that the principles for recognizing items that meet the definition of an element of financial statements in the financial statement are not in harmony with the principles of the representational theory of measurement. The responses to Section 4 highlight the point that the majority of accountants are not aware that accounting information in financial statements is not objective. Furthermore, they are not aware that accounting information in financial statements describes phenomena that are not objective. This suggests that accountants are not aware that the characteristics of accounting information are not in harmony with the principles of the representational theory of measurement.

The majority of respondents in Section 5 indicated that they were not aware that measurement occurs at a specific point in time. Furthermore, accountants are not aware that it is impossible to achieve measurement in the accounting discipline under the going concern concept. Finally, in Section 6 the responses of the accountants generally indicate that the majority of accountants are familiar with the principles of the representational theory of measurement. However, the responses also indicate that the majority of accountants are not familiar with the concept of error in measurement.

The overall conclusion to be derived from this empirical study is consistent with the hypothesis in chapter 1 that accountants are not aware that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement.

Chapter 13-Towards a model of accounting measurement

13.1 Introduction

The research discussed in the previous chapters of this thesis explored various issues regarding the application of the representational theory of measurement to accounting. The consistent message that came out in previous chapters was that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement. Broadly speaking, the main reason for this is that accounting phenomena are not currently measurable. In order to be considered measurable, accounting phenomena must be compatible with the principles of measurement that establish the measurability of phenomena (see chapter 2). A further reason may be that accountants are not familiar with the principles of the representational theory of measurement. The outcomes of the questionnaire, discussed in chapter 12, further motivated this observation. Statements in the questionnaire were based on certain problem areas surrounding the current accounting concept of measurement. It was established that a description of the measurement problem in the accounting concept of measurement may be needed.

The purpose of this chapter is to describe the reality of the problem situation in accounting, to develop a conceptual model for the problems in the accounting concept of measurement that is based on the principles of the representational theory of measurement, and to discuss part of the formulation of a scientific model to address the problem. This chapter also provides a precise definition of the nature of the numerical assignments in the accounting discipline.

The chapter commences with a discussion of the reality problem situation in accounting and the development of the conceptual model of the reality problem in section 13.2 and its subsections, followed by a proposition for a scientific model of

a solution to the measurement problem in accounting in section 13.3. The conclusion appears in section 13.4.

13.2 The reality problem situation in accounting measurement and the development of its conceptual model

In this section, Mitroff's (1974) 4-phase model for problem solving is used to contextualize and develop a conceptual model of the problems within the accounting concept of measurement. The Mitroff model, introduced in chapter 1 and fully discussed in chapter 11, prescribes four phases of development. As this study is exploratory in nature, phase 3 and phase 4 of Mitroff's (1974) model will not be discussed in this section. The discussion is limited to phases 1 and 2. A proposition for a scientific model of accounting measurement is also made. That is, part of phase 3 of Mitroff's (1974) model is discussed.

13.2.1 Phase 1 of Mitroff's 4-phase problem-solving model

This phase stipulates the identification of a reality problem situation. In this thesis the problem situation may be contextualized as follows:

- There is consensus in the accounting discipline that accounting research has not succeeded in creating a theory of accounting measurement from the observation of accounting measurement practices. In chapter 2 it was noted that every practice of measurement should have an underlying theory of measurement. It is therefore evident from this that accounting practices are not practices of measurement; if they were they would have an underlying theory of measurement.
- Accounting research has also established that there are no specified scales of measurement or attributes of accounting phenomena that are of use and interest to measure. In particular, it was noted that the attributes of value that are measurable are not specified. The concept of measurement requires that every measurement process must specify the scale of

measurement and the attribute that is being measured. It was noted in chapter 2 that the concept of accounting measurement assigns monetary units to represent the value of the elements of financial statements. It was established that the scale of measurement that is used to assign monetary units to the units of value is not specified. In chapter 2 it was remarked that every process of measurement must specify the scale used in the process. It can be concluded from this that the process of assigning monetary units to represent the value of the elements of financial statements is not a process of measurement.

- Various criticisms presented in chapter 3 indicated that the definition of accounting and the objectives of accounting are not in harmony with the principles of the representational theory of measurement. Of the main criticisms, was the issue that an empirically true value of a measured quantity exists in accounting. In chapter 2 it was noted that all measurements have an error of some sort. This indicates the inadequacy of the accounting concept of measurement in dealing with the concept of error in measurement.
- In chapter 4 it was suggested that the concept of a scale is misapplied in the accounting discipline, yet every measurement process requires the specification of a scale of measurement that can be used to determine the extent to which an object in a particular class possesses a specified property. Measurement information becomes meaningful once a scale of measurement has been specified (see chapter 2). It follows then that the absence of a scale of measurement in accounting implies that accounting measurements are not meaningful. Narens (2002) also points out that a scale of measurement explains the relationship between a numerical relational structure and the empirical relational structure that it purports to represent. In the absence of a specified scale of measurement, it would not be possible for individuals to determine whether or not they were drawing appropriate inferences about the empirical relational structure from the numerical relational structure.

- It was established in chapter 5 that the accounting concept of measurement under the going concern concept is not in harmony with the principles of the representational theory of measurement. It is evident from this that it is currently not possible to measure accounting phenomena under the going concern concept. However, in chapter 5 it was noted that the financial statements of entities whose operations are expected to continue for the foreseeable future are supposed to be prepared under the going concern assumption. Consequently, this indicates that financial statements of entities that are prepared under going concern do not contain measurement information.
- The analysis of the accounting concept of value in chapter 6 revealed that the current qualities of value render it immeasurable under the principles of the representational theory of measurement. It was also established in chapter 6 that an item that meets the definition of an element of financial statements should be recognized in the financial statements if it has a cost or value that can be measured with reliability. It can be inferred from this that currently the elements of financial statements are recognized when they do not have value or cost that can be measured reliably. Since the value or cost of an element of financial statements is not currently measurable, a new attribute or attributes of value or cost that are measurable should be found.
- It was also noted in chapter 7 that accounting measurements are not objective, yet, in chapter 2 it was established that the principles of the representational theory of measurement require that all measurements that are within the category of this theory must be objective. This indicates that accounting measurements do not reflect the characteristics of true representational measurements. Furthermore, it was noted that accounting phenomena are not objective. In particular, cost and value are not objective. Cost and value are specified in the accounting literature (IASB, 2006) as the objects of measurement. It is therefore evident from this that if

- cost or value were measurable phenomena they would have been in harmony with the principles of the representational theory of measurement.
- The criticisms in chapter 8 highlight the fact that accounting measurements are relative to a specific frame of reference. However, the accounting literature (IASB, 2006) does not recognize that accounting measurement information must be viewed relative to this specific frame of reference, that is, relative to a specific business entity. In particular, it was noted that the IASB framework (2006) for financial reporting advocates that accounting measurements should be comparable across different entities and across different accounting periods without specifying the conditions under which measurement can be compared. In chapter 2 it was noted that measurements are relative to a specific entity. This means that accounting is not a measurement discipline.
 - The ways of presenting financial information in financial statements were criticised in chapter 9. It was established that the financial statements are presented in a way that is not consistent with the principles of the representational theory of measurement. It is therefore necessary to find other ways of presenting accounting information that are consistent with these principles.
 - In chapter 10 it was argued that the conditions under which accounting information can be considered meaningful are not specified. In chapter 2 it was noted that every measurement process requires the specification of the conditions under which the measurement information it produces can be considered meaningful. The conditions of meaningfulness are specified once a scale of measurement is specified. It was noted that there are no specified scales of measurement in accounting. It is therefore evident that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement.
 - The outcomes of the questionnaire in chapter 12 reveal that accountants who are responsible for creating measurement knowledge in accounting

and who are also responsible for measuring the attributes of accounting phenomena are not familiar with the principles of the representational theory of measurement. This suggests that the principles of this theory should be incorporated into the education curriculum of accountants. This would make accountants familiar with them.

13.2.2 Phase 2 of Mitroff's 4-phase problem solving model

The second phase of Mitroff's *et al.* (1974) model deals with the development of the conceptual model. This phase defines the problem to be solved in broad terms and specifies any variables that will be used to define the nature of the problem. The problems in the accounting concept of measurement have been discussed in chapter 2 to chapter 12. The field variables identified in these chapters concern mainly the areas of measurement discussed in the sections that follow:

13.2.2.1 The concept of representational measurement

In chapter 1 it was noted that accounting is a social science. This means that the only way accounting can be considered to be a measurement discipline is if accounting practices are in harmony with the principles of the theory of measurement. It can also be inferred that the field variables that are necessary in the development of the conceptual model of the problems in the accounting concept of measurement are determined by the requirements of the representational theory of measurement. As a result, it can be argued that the basis of the conceptual model of the measurement problem in accounting is founded on the process of the representational theory of measurement. Decoene *et al.* (1995:234) describe the process of representational measurement as follows:

One starts from an empirical relational structure, which consists of a set X of objects (or events) characterized by a collection of descriptive events – relations R_i and possibly a collection of functional elements – operations o_i – defined with respect to these relations. The RTM concentrates on how to

describe the empirical relational structure as succinctly and accurately as possible. This is done by formulating a set of qualitative axioms, which are an abstract description of what the empirical relational structure is. To study the possibility of measuring this empirical relational structure, RTM asks whether it can be represented by an abstract structure (in most cases Reals), given the set of qualitative axioms. To achieve this, RTM tries to prove both a representation and a uniqueness theorem. The representation theorem proves the existence of an order preserving mapping f from the empirical relational structure into the abstract relational structure. The uniqueness theorem proves which transformations $f \longrightarrow f'$ are admissible.

The extract indicates that the process of representational measurement has a specific starting point. It has to start with the identification of the object whose attributes are the subject of measurement. It is clear from this that a precise and clear description of the qualitative structure of the phenomenon to be measured is necessary before measurement can take place. The extract also outlines the fact that the identification of the object of measurement has to be followed by the identification of the attributes to be measured. Precise knowledge of the attributes to be measured is also required. It is evident from this that precise knowledge of the empirical relational structure of the phenomenon to be measured is necessary before measurement can take place. The excerpt also points out that the possibility of measurement is confirmed when an abstract structure that can be used to represent an empirical relational structure is found. That is to say, a search should be conducted to find a suitable numerical relational structure for representing the empirical relational structure. It is also clear from the extract that there are no set rules for choosing the numerical relational structure. The choice is entirely arbitrary. The extract also points out that after the abstract structure (numerical relational structure) is found it is necessary to specify the scales of measurement. That is, it is necessary to specify the relationship between the numerical relational structure and the empirical relational structure. This is

because the relationship specifies how the numerical relational structure represents the properties of the empirical relational structure. The specification of a scale of measurement is equivalent to proving the representation and uniqueness theorems (see chapter 2). This discussion highlights the procedures that create representational measurements. Anything short of this results in other representations, but not representational measurements. Therefore, if accounting is to be considered a measurement discipline, it has to adhere to these principles.

Figure 13.21 below is a flow chart which expresses the characteristics of the process of representational measurement. It helps to explain the kind of process that the accounting discipline needs to follow before it can be considered a measurement discipline. In Figure 13.20 some of the symbols used in flow charts designed in this thesis are explained.

Figure 13.20 Explanation of symbols used in flowcharting processes of measurement

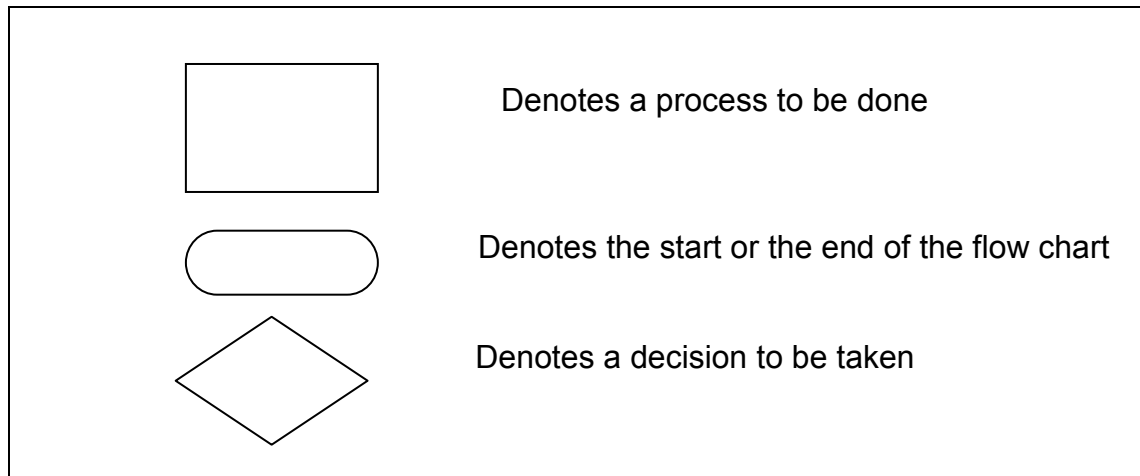
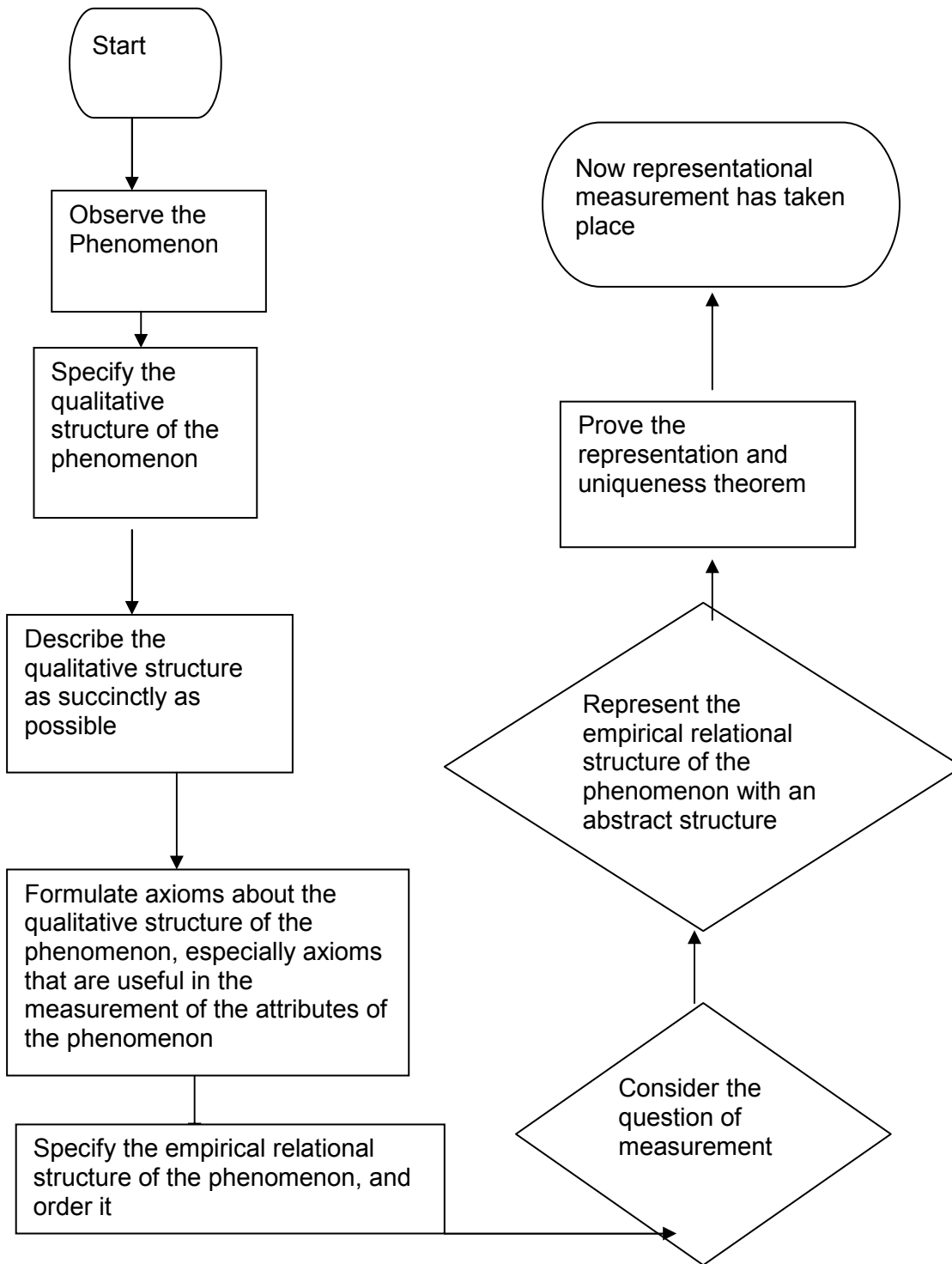




Figure 13.21 Flow chart depicting the process of representational measurement



Source (Own observation)

The flow chart shows the processes that must be followed under the representational theory of measurement. It is clear from the flow chart that it is necessary to have detailed knowledge of the phenomenon that is being studied before measurement takes place. Stevens (1951) points out that measurements have the advantage of validity. This means that whatever is discussed in the context of measurements must be empirically testable. This explains the need for the specification of the qualitative structure of the phenomena. It follows that if accounting is to be considered a measurement discipline it is necessary to specify the qualitative structures of accounting phenomena that are the subject of measurement. According to Vorster *et al.* (2008), the phenomena that are the subject of measurement are cost and value. This means that precise knowledge of cost or value is needed in accounting before measurement can take place. Axioms are true statements about the qualitative structure and in the case of measurement; they must be useful in the measurement of the attributes of the phenomenon. These can only be formulated once a clear understanding of the phenomenon has been acquired. Thus, it is clear from that the axioms that are necessary for measuring value can only be formulated once the qualitative structure is adequately understood.

In essence, representational measurement is an attempt to understand the nature of empirical observations that can be recorded in some reasonably unique fashion, in terms of familiar mathematical structures. According to Adams (1966), the representational theory of measurement is built on the basis that mathematical operations and relations are made to correspond to or represent empirical relations. From the flow chart, it is clear that the question of measurement is only answered if it can be shown that the qualitative structure can be represented by an abstract structure. Usually real numbers are used for this purpose. The representation and uniqueness theorems are proved once a scale of measurement has been satisfied. In the accounting discipline (IASB, 2006) monetary units are considered to be measures of the value of the elements of financial statements. This means that a function that specifies the relationship between monetary units and value is a scale of measurement in accounting. In

chapter 1 it was noted that the relationship between monetary units and value is not known. This suggests that there are no scales of measurement in accounting. If accounting is to be considered a measurement discipline, there must be specified scales of measurement. These are the procedures that all the systems in the social sciences need to follow for measurement to take place. Currently, the requirements of representational measurement are not being fulfilled in the accounting discipline.

13.2.2.2 Measurements versus indicants in accounting

The measurement problem in accounting is exacerbated by the lack of a clear distinction between measurements and indicants. Most of the so-called accounting measurements are not measurements at all. They fall under the category of indicants. According to Stevens (1951), indicants are effects or correlates related to psychological dimensions by unknown laws. These indicants are commonly confused with measures in accounting. Abdel-Magid (1979) confuses an indicant with a measure when he argues that the property subject to measurement in an exchange transaction is exchange value, which is measured by the monetary numerosity at the time of exchange. In this case, the relationship between value and the amount of monetary units paid for the value is not known. This is because value is a subjective concept (see, chapter 6) and there is no scale that can be used currently to measure value. Thus, it can be concluded that value is a hypothetical phenomenon. Value is related to the quantity of monetary units assigned to represent it by unknown psychological laws.

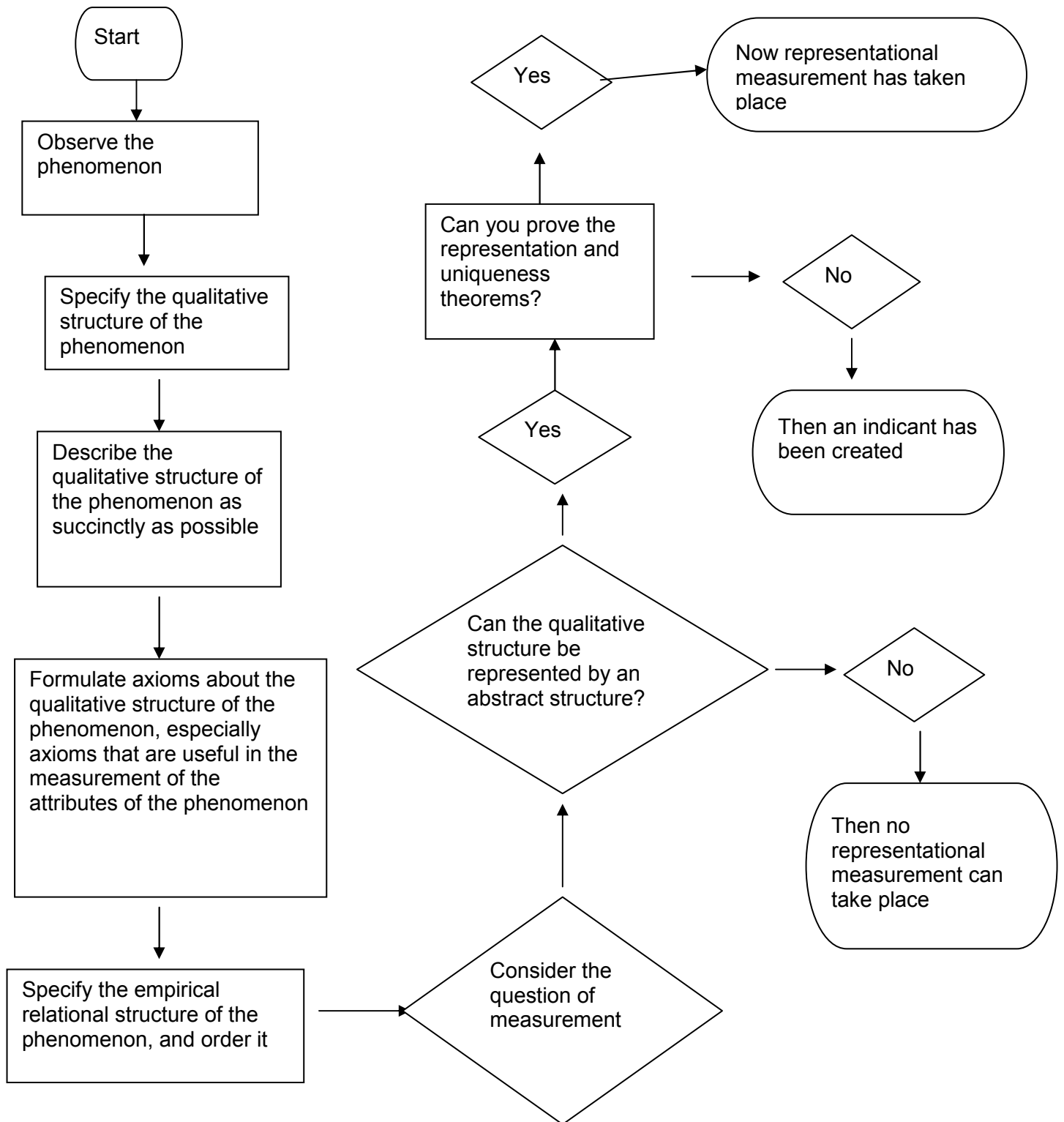
In chapter 6 it was established that measurement only occurs when the relationship between the indicant and the dimensions of the entity in question are known. Stevens (1951) also argues that the difference between an indicant and a measure is that the indicant is a presumed effect or correlate that bears an unknown (but usually monotonic) relation to some underlying phenomena, whereas a measure is a scaled value of the phenomenon itself. In accounting, it seems the word measurement is used to refer to both measurements and

indicants. This is because monetary units are regarded as measures of value (see, IASB, 2006) in the absence of a valid relationship between monetary units and value. Ryan *et al.* (2002) point out that the relationship between monetary units and value is currently unknown. This indicates that currently the relationship between monetary units and value is psychological. Furthermore, 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 (Decoene *et al.*, 1995). It is evident from this that a measure of a phenomenon emerges from an explicit theory into which that phenomenon is incorporated. It also follows that all indicants are pre-theoretical and should not therefore be referred to as measurements.

The lack of success of accounting researchers in creating a theory of accounting measurement suggests that so-called accounting measurements are not measurements at all but indicants. It should be noted that there is nothing wrong with the use of indicants in a discipline. Luce *et al.* (1990) point out that the use of indicants for pre-theoretical variables may be a useful initial step towards the creation of such a theory for the measurement of the variable, but index creation for a variable must not be confused with the measurement of the variable. The confusion that is currently prevalent in the accounting discipline is that the amount of monetary units that is paid for the value of a commodity is considered to be a measure of the value of that commodity, but the amount of monetary units paid for the value of a commodity is merely an indicant. As a result the accounting discipline should drop the claim that it is capable of measuring value until such a time when it can prove that it is able to do so.

Figure **13.3** below is a flow chart that contrasts indicants versus measurements. It highlights the differences in the process that creates indicants and the process that creates measurements.

Figure 13.3 Measurements versus indicants



Source (Own Observation)

The diagram illustrates the similarities between measurements and indicants. From the flow chart above, it is clear that measurement only occurs once the uniqueness and the representation theorems can be proved. Luce and Narens (1994) point out that representational measurement occurs if and only if the representation and uniqueness theorems can be proved. It follows that proving these theorems is equivalent to proving a theory of measurement. According to Narens (2002), proving the uniqueness and representation theorems is equivalent to the establishment of a scale of measurement. For measurement to occur, a direct assessment of the phenomenon is required. But a direct assessment of the phenomena that are being measured is lacking in the accounting discipline. This is indicated by the fact that there is no known direct relationship between monetary units and the phenomena they are supposed to represent. Ryan *et al.* (2002:118) point out that there is no agreement relating the amount of monetary units paid to acquire a commodity and its value. This means that the amount of monetary units paid to acquire a commodity is an effect or correlate related to the psychological dimensions of value by unknown laws. It follows then that the amount of monetary units paid to acquire a commodity is not a scaled correlate of the underlying phenomenon of value. Consequently, it can be concluded that, contrary to popular belief, value is not currently measurable in accounting,

13.2.2.3 Measurement and accounting reality

The principles of the representational theory of measurement can only be applied to something that is real. In chapter 2 (Decoene *et al.*, 1995), it was noted that 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 means that for the accounting discipline to be a measurement discipline, its measurement magnitudes must be descriptions of objectively existing accounting entities. In the accounting discipline, accounting realities are created by events. Events are about what has happened (Gouws and Van der Poll, 2004). Since measurement is possible only

with empirical phenomena, it is clear that it is only the attributes of events that are measurable. According to Decoene *et al.* (1995), the defining feature of the representational theory of measurement is the belief that questions of measurement must be grounded in how reality is structured. In other words, the application of the representational theory of measurement depends entirely on the understanding of that part of the reality one is studying. Therefore, in order to measure the attributes of accounting events, an understanding of the qualitative structure of the accounting event is required. It would then be possible to identify the attributes of the reality one is studying. In addition, there is no way of posing the question of measurement of a variable prior to an understanding of the structure of that variable (Decoene *et al.*, 1995). It is thus necessary to understand the phenomena that are being measured before measurement can take place. As a result, it is only the attributes of accounting events that are capable of being measured.

13.2.2.4 Measurement and simulated reality in accounting

The accounting discipline plays loosely with the term “measure”. It is conceivable that one may seek to quantify a property of some not yet existent phenomena. The question is whether such quantifications can be described as measurements. The quantification of as yet nonexistent phenomena is simulated reality. According to Gouws and Van der Poll, (2004), simulated reality in the accounting discipline is regulated by assumptions, namely matching, accruals, prudence and going concern. Since assumptions are beliefs that something is true or that something will happen although there is no proof (Hornby, 2005), it follows that unknown psychological laws bind the properties of the phenomena that are subject to these beliefs. Consequently, unknown laws also bind the amounts of monetary units assigned to the properties of simulated reality in the accounting discipline. The assignment of monetary units to the properties of simulated reality in accounting can thus only result in the production of indicants and not measures.

The general confusion between the identification of indicants and of measures in the quantification of the attributes of simulated reality is a result of the current lack of success of the accounting discipline in identifying exactly what the numerosity of monetary units represents in accounting. Value is believed to be an important variable influencing the amount of monetary units paid to acquire a commodity. But, the amount of monetary units indicates a ratio scale measure of monetary units and not of value. The ratio character of monetary unit measurement is based on the numerical representation of monetary unit intervals so that the value associated with the concatenation of adjacent intervals is the sum of values associated with those intervals. This is carried out in practice by counting the smallest denomination of the monetary units.

But, the viewpoint that the intervals of the units of value are represented by the intervals of monetary units has as far as is known nothing empirically to do with value. Authors such as Stamp (1981), Tinker (1985), McLean (2006) and Ryan *et al.* (2002), have noted that value is ambiguous and not an intrinsic property of anything. As a result, there is no general agreement among accountants about what value is and how it should be measured. If there is no reason for believing that the intervals of value are represented by the empirical structure of monetary units, then there is nothing empirical about value that limits which monotonic transformations of monetary units can be used as indices of value.

The operation of measuring, in the simplest of cases, entails the establishment, by observation, of correspondence between the magnitude of a property of an object and a particular point on a calibrated scale, which is designed to represent various magnitudes of that property (Chambers, 1997). This means that measurements must correspond closely to real world phenomena. That is to say, measurements must be true representations of the properties of the phenomena that they are measuring. Therefore, measurements must exhibit the same properties as the phenomenon they are measuring. If they do not, they should not be classified as measurements.

Moreover, in accounting the source of simulated reality is future events. According to Gouws and Van der Poll (2004), the tool that was created to handle these “future events” is the so-called book entry. A book entry is a representation of something that has not happened and therefore cannot be observed. Thus quantifications of the attributes of phenomena represented by book entries do not correspond closely to real world phenomena and cannot be considered to be theoretical. They cannot help explain real world phenomena and observations.

A theory of accounting measurement cannot therefore be developed from quantifications of the attributes of accounting simulated reality. It is also evident that the quantifications of the attributes of accounting simulated reality should not be aggregated as it is not known exactly what they represent. The quantifications of the attributes of accounting realities should not be added to each other or to the quantifications of the attributes of accounting simulated reality unless these quantifications satisfy the principle of homogeneity (see, chapter 6). According to the principle of homogeneity, the addition of such quantifications can only occur if the phenomena they are representing are not structurally different (Luce, 1996). Addition of monetary units representing simulated reality is common in the income statement and balance sheet (see, chapter 5 and chapter 9). Thus the addition operation should not be used unless the homogeneity of the structures of the elements being added has been confirmed.

13.2.2.5 The accounting conceptual framework as a basis of accounting measurement

The common belief among accountants that the accounting conceptual framework contains the foundations of accounting measurement adds to the problems facing accounting today. The outcomes of the questionnaire discussed in chapter 12 indicate that the majority of accountants view the conceptual framework (IASB, 2006) as containing the foundations of measurement. Yet, as was established in chapter 1 to 10, there are no foundations of accounting measurement in the

accounting conceptual framework. This is also an indication that accountants are not familiar with the principles of the representational theory of measurement.

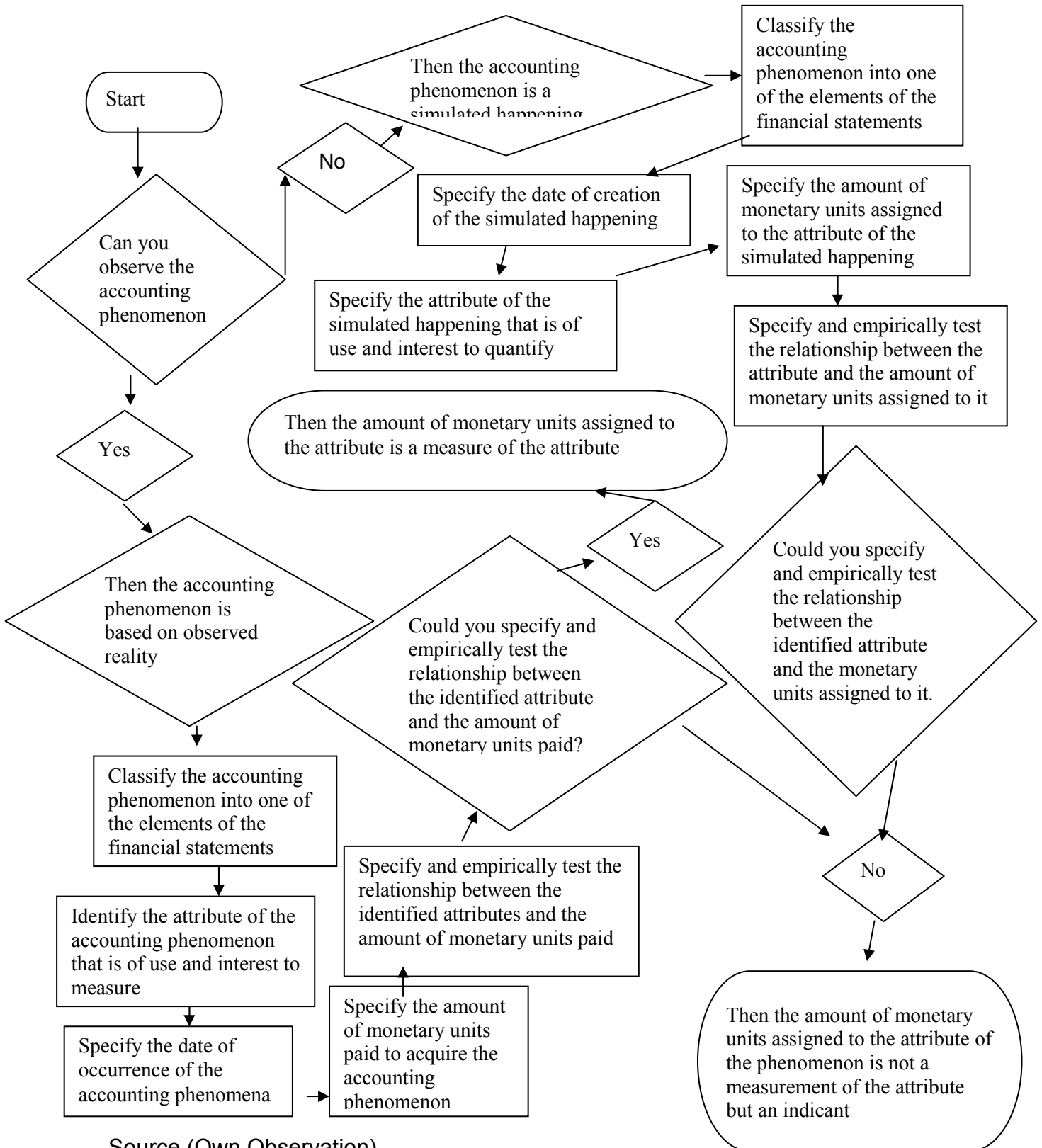
If this is the case, it follows that accounting should not be referred to as a measurement discipline. Furthermore, accountants need to be educated in the concept of representational measurement. In chapter 6, it was established that the bases of accounting measurement (historical cost, current cost, fair value, realizable value and present value) are not in harmony with the principles of the representational theory of measurement. This indicates that accountants do not have an adequate understanding of the principles of the representational theory of measurement, with the result that they are not able to assess whether the accounting conceptual framework contains the foundations of accounting measurement.

13.3 Creating indicants and measurements in the accounting discipline

In this section, part of phase 3 of the Mitroff *et al.* (1974) model is discussed. Part of the scientific model of the reality problem and part of the solution to the reality problem are covered in this section. It illustrates the processes that the accounting discipline should follow in creating measurements and indicants. Currently, the accounting discipline is creating indicants. Furthermore, it has been noted in chapter 6 that currently the accounting discipline refers to indicants as measurements. Figure 13.4 illustrates the processes of creating indicants. This is the scientific model of the problem situation. The figure also illustrates the processes that create measurements. This forms part of the solution to the reality problem. A full solution requires a proper definition of the measurement spaces of accounting phenomena and an empirical testing of the properties of the measurement space. It also involves the selection of abstract structures to represent the properties of the empirical relational structure of accounting phenomena. Empirical testing will also be required to ensure that the abstract structure exhibits the same properties as the empirical relational structure.

It should be noted that both measurements and indicants could be useful to a discipline. Stevens (1951) points out that indicants have the advantage of convenience, while measurements have the advantage of validity. A discipline may aspire to measure, but it is often forced to settle for indicants. From the analysis carried out in the previous chapters it is clear that this is indeed the case in the accounting discipline. In Chapter 11, it was noted that the qualitative characteristics of financial statements (namely, comparability, reliability, relevance and understandability) indicate the need for the accounting discipline to be a measurement discipline. This discipline is currently considered to be a measurement discipline (e.g. IASB, 2006; Kirk, 2005; Vorster *et al.*, 2008; Wolk *et al.* 2001), when in fact it is not a measurement discipline, but a discipline that uses indicants. It is therefore necessary to outline the accounting processes that create an indicant and contrast them with those that can create measurements. Figure 13.4 below reflects the processes that should be followed in accounting when creating a measurement and an indicant.

Figure 13.4 Steps to creating indicants and measurements in accounting



Source (Own Observation)

From the flow chart above it is clear that there are two types of phenomena in accounting. One type can be observed while the other is based on simulated reality. Since Decoene *et al.* (1995) stipulate that magnitudes are historically and theoretically determined reflections of quantitative aspects of objectively existing entities and not merely the outcome of metricization or measuring procedures, it follows that with regard to observed reality in accounting such phenomena can be regarded as existing objectively. In order to measure their attributes a detailed theoretical analysis of the phenomena has to be carried out. The attribute that is of use and interest to measure should be identified, analyzed and adequately understood.

In the accounting discipline an attribute is identified as cost or value. For instance, IASB (2006) points out that an item that meets the definition of an element should be recognized if it has a cost or value that can be measured with reliability. However, to date, the accounting discipline has not been able to clearly define cost or value. For example, Tinker (1985) points out that value and cost are both ambiguous concepts, and not intrinsic properties of an accounting entity. As a result, there is no general agreement among accountants on the meaning of cost or value. As outlined earlier, (Ryan *et al.*, 2002), there is no general agreement in the accounting discipline when relating the amount of monetary units paid for a commodity and its value. This means that there is no scale of assigning monetary units to the units of value in accounting. Therefore, it follows that value is not measurable in accounting. In chapter 7 it was noted that cost is an ambiguous concept. It follows then that cost cannot be defined precisely. Consequently, from the representational perspective, cost is not measurable.

From the flow chart above it is clear that the relationship between value and the amount of monetary units used to represent value must be specified and the relationship must be empirically testable for measurement to occur. Furthermore, according to Orbach (1978:44), measurement theory requires that at least one empirical attribute be specified, but in the accounting discipline there is no such

specification. As a result, what are referred to as measurements in accounting, are merely indicants. With regard to simulated reality, as illustrated by the flow chart, no measurement is possible. This is because simulated realities do not have specified empirical attributes. The simulated realities are not empirical at all and consequently they cannot have empirical attributes. It can therefore be concluded that in accounting representational measurement is not possible with simulated reality.

13.4 Conclusion

In this chapter a comprehensive framework for approaching the measurement problem in accounting is proposed. A representational form of measurement is proposed for the accounting discipline. Currently, the accounting discipline is not aware of the distinction between measurements and indicants. The accounting conceptual framework (IASB, 2006) does not represent the foundations of accounting measurement as previously believed: the foundations of accounting measurement have yet to be developed.

It has been proposed in this chapter that the foundations of accounting measurement should be based on the principles of the representational theory of measurement. Most of the quantifications in accounting fall under the concept of indicants. They thus fall short of the requirements of the representational theory of measurement.

In this chapter, the reality problem situation in accounting has been described; the conceptual model of the problem has been developed, and part of the scientific model of the reality problem and part of the solution to the reality problem has been discussed. Since accounting is considered to be a social science it would make sense if the accounting concept of measurement were in harmony with the principles of the representational theory of measurement.

Chapter 14-Conclusions and suggestions for future research

14.1 Introduction

A very broad range of perspectives (theoretical and empirical) has been covered in the last thirteen chapters. It is therefore necessary to identify the main themes that have emerged and to show how each has contributed to a better understanding of the accounting concept of measurement.

In chapter 1 the point was made that this study is exploratory in nature. The objectives of the study were:

- To determine whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement
- To determine whether accounting is a measurement discipline as suggested by the accounting literature
- To investigate whether chartered accountants are aware that accounting is a measurement discipline or not
- To propose new areas of future research to address the problem of accounting measurement
- To develop a conceptual model of the problem of accounting measurement
- To propose a scientific model of the problem of accounting measurement
- To propose a scientific model of a solution to the accounting measurement problem

These objectives have been achieved, as discussed in the last thirteen chapters.

The purpose of the present chapter is to summarize some of the most important theoretical and empirical conclusions, to identify the limitations of the study, and to make recommendations and suggestions for future research.

This chapter commences with a summarization of the conclusions drawn from the theoretical and empirical research in section 14.2. It will go on to discuss the limitations of the research in section 14.3, followed by the contributions made by

the study in section 14.4. A discussion of the possible areas for future research will close the study in section 14.5.

14.2 Conclusions

As was outlined in chapter 1, this study consisted of a theoretical as well as an empirical component. In the subsections that follow the main conclusions that were drawn from each of these components are summarized under separate headings.

14.2.1 Conclusions from a theoretical perspective

In chapter 2 the principles of the representational theory of measurement were discussed. It became evident that until recently (Luce *et al.*, 1971, 1989, 1990) a comprehensive theory of measurement for the social sciences was lacking. This suggests that the principles of the representational theory of measurement have not had a chance to be properly applied in the social science disciplines. As a result, it has been judged necessary to investigate whether the accounting concept of measurement is in harmony with the principles of the representational theory of measurement. It also follows that the principles of the representational theory of measurement should be included in the academic curriculum of social science disciplines. Currently, the academic accounting curriculum does not include the principles of this theory of measurement.

It was noted in chapter 3 that the term measurement is a common one in contemporary accounting literature. It was also found that financial reporting is regarded as the reporting of accounting measurement information. The main conclusion that was drawn from this was that measurement forms the major part of the financial reporting methodology. It is therefore necessary that accountants have an adequate knowledge of the principles of measurement in order to adequately measure accounting phenomena. In chapter 3 it was established that the inclusion of the term measurement in the accounting literature seems to have preceded any thoroughgoing analysis of measurement's essential meaning and

corresponding implications to the discipline. The definition of accounting is not compatible with the principles of the representational theory of measurement. It was also established that the objectives of financial reporting are not compatible with the principles of the representational theory of measurement. The obvious conclusion to be drawn from this is that, from the perspective of the representational theory of measurement, the accounting concept of measurement is not in harmony with this theory.

The application of the concept of a scale in accounting measurement was discussed in chapter 4. It was established that there are no scales of measurement in accounting. Yet, in chapter 2 the point was made that every process of measurement must specify a scale. The relationship between monetary units paid to acquire a commodity and its value is not known. Furthermore, attempts to apply the concept of a scale to accounting resulted in misapplications. For instance, the concepts of ratio, interval and ordinal scales are not properly applied in the accounting discipline. This suggests that accountants are not familiar with the principles of representational measurement. Moreover, this means that according to the principles of the representational theory of measurement, accounting cannot be considered a measurement discipline.

In chapter 5, the possibility of measuring accounting phenomena under the principles of the going concern concept was discussed. It was established that under the going concern concept, accounting phenomena are assumed to flow non-stop through a business entity over time until the liquidation point. As a result, an arbitrary cut-off point has to be established in order to prepare the periodic financial statements. It is not possible to measure the financial position of an entity whose business activities are in motion: only the momentum of the business activities can be measured. However, it was noted that it is also not possible to measure the momentum of business activities. The mathematical principles of natural philosophy, in particular the laws of motion, are not applicable to accounting phenomena. Some accounting phenomena are based

on simulated reality while others are not. Accounting is a social science and its foundations cannot be analogous to that of a natural science. As a result, representational measurement is not possible under the going concern concept.

The discussion in chapter 6 focused on whether it is possible to measure accounting value. The concept of value lacks a precise definition, as it exists in the mind of the individual. The concept of measurement is only applicable to empirical phenomena. Furthermore, there is no specified scale of value that indicates the amount of value in a commodity. It was also noted in chapter 6 that accountants currently believe that the amount of monetary units paid to acquire a commodity is a measure of its value. A theory for the measurement of monetary units exists but there is no corresponding theory for the measurement of value. Monetary units are not measures of value, but indicators of value. Indicators are effects or correlates related to psychological dimensions by unknown laws. Value is related to the quantity of monetary units by unknown psychological laws. It was thus also established in chapter 6 that the dimensions and qualities of accounting phenomena are not measurable. Moreover, the bases of accounting measurement are not in harmony with the principles of representational measurement. Therefore, it follows that value is currently not measurable.

In chapter 7, it was investigated whether accounting measurements are objective. Representational measurement literature (Luce *et al.*, 1971) points out that the empirical relational structure and its empirical properties should be regarded as a set of empirical laws. This means that all representational measurement must be capable of being objectively determined. It was noted, however, that the qualitative structures of accounting phenomena and their properties cannot be regarded as a set of qualitative empirical laws. All measurements are supposed to be objective in the community of discussion. As a result, accounting phenomena are not measurable as they cannot be objectively determined. It also follows then that numerical representations of accounting phenomena are not objective.

The relativism of the accounting concept of measurement was investigated in chapter 8. It was noted that accounting measurements are dependent on the concepts of cognitive relativism, cultural relativism, linguistic relativism and contractual relativism. However, it was established that the accounting concept of measurement does not recognize the effects of these sources of relativism in measurement. In representational measurement literature (Luce *et al.*, 1971), it is important to note that every pair of the representation and uniqueness theorems involves a choice of a numerical relational structure. This choice is essentially a matter of convention. The accounting concept of measurement does not take into account the fact that every pair of the representation and uniqueness theorems is a matter of convention, nor that each measurement should be evaluated relative to a specific frame of reference.

The investigation in chapter 9 focused on whether financial statements are presented in a way that is consistent with the principles of the representational theory of measurement. It was established that financial statements are prepared on the premise that the monetary amounts that are used to represent the attribute of elements of financial statements can be freely added or subtracted. However, value is currently an ambiguous concept that is not an intrinsic property of an accounting entity: consequently, it cannot be measured. Furthermore, there is no agreement relating the number of monetary units paid to acquire a commodity to its value. This indicates that the scale that is used to assign monetary units to the value of elements of financial statements is not specified. But, as has been noted throughout this study, measurement cannot occur in the absence of a specified scale of measurement. Consequently, this suggests that financial statements are not presented in a way that is consistent with the principles of the representational theory of measurement.

In chapter 10, the concept of meaningfulness in accounting was discussed. It was established that this concept relates to the use to which the measurement information may be put. It was further established that the meaningfulness of a

measurement exists once a scale of measurement has been specified. There are no specified scales of measurement in accounting. This suggests that the accounting concept of measurement is not in harmony with the principles of the representational theory of measurement. It was also highlighted that the qualitative characteristics of financial statements have meaning in the presence of specified scales of measurement. Since there are no specified scales of measurement in the accounting discipline, it may be concluded that under the representational theory of measurement, accounting information is not meaningful.

14.2.2 Conclusions from the empirical perspective

Survey research was conducted to establish whether accountants are familiar with the principles of representational measurement. The research methodology used was described in chapter 11. The questionnaire was divided into six areas of enquiry. The conclusions drawn from each area of enquiry are discussed in the sections that follow.

14.2.2.1 Measurement in the accounting conceptual framework context

This section investigated whether accountants believe that the IASB framework (2006) for financial reporting is a framework for accounting measurement. Five statements were used to investigate this aspect of the questionnaire. The first statement investigates whether accountants consider the IASB framework for financial reporting to be a framework for accounting measurement. The results of this statement clearly indicated that the majority of accountants believe that measurement occurs in the accounting conceptual framework context. Four of the statements linked the qualitative characteristics of financial statements to the concept of meaning. These four statements investigated whether accountants are aware that the concept of meaningfulness is a precondition for financial statements to possess the qualitative characteristics (reliability, understandability,

relevance and comparability) outlined in the IASB framework (2006) for financial reporting. The majority of accountants indicated that they are aware that the measurement concept of meaningfulness is a precondition for accounting information to possess the qualitative characteristics of the financial statement.

It has been established in this study that accounting information is not meaningful. The specification of a scale of measurement is a precondition if measurement information to be considered meaningful. However, accounting research has indicated that there are no specified scales of measurement in the accounting discipline. No measurement can take place without a specified scale of measurement. This suggests that no measurement is currently occurring under the accounting conceptual framework. The obvious conclusion to be drawn from the responses to this section is that accountants are not aware of this situation. It also indicates that accountants are not familiar with the principles of representational measurement.

14.2.2.2 Measurement and the nature of accounting phenomena under the accounting conceptual framework

This section investigated whether accountants are aware of the characteristics that a phenomenon must possess before it can be considered measurable. This section consisted of five statements. These statements investigated whether accountants are aware that there are no attributes of accounting phenomena that are currently being measured under the accounting conceptual framework. The majority of respondents indicated that they believe that there are attributes of accounting phenomena that are currently being measured under the accounting conceptual framework. Yet, it has been established in this study that accounting research indicates that there are no specified attributes that are of use and interest to measure in preparing financial statements. All measurement processes require the specification of attributes that are the subject of measurement. This suggests that accountants are not familiar with the principles of representational

measurement. It is therefore essential that the principles of representational measurement are included in the academic curriculum for accountants.

14.2.2.3 Measurement and the recognition of accounting phenomena

This section was designed to investigate whether accountants are aware that the principles of recognizing the elements of financial statements in these statements are not in harmony with the principles of the representational theory of measurement. This section consisted of five statements. The responses to these statements indicated that accountants are not aware that that the principles for recognizing the elements of the financial statements are not in harmony with the principles of the representational theory of measurement. It can be concluded from this that accountants are not familiar with the principles of the representational theory of measurement.

14.2.2.4 The integrity of accounting information created under the accounting conceptual framework

The statements in this section were designed to test whether accountants are aware that accounting measurement information is created from phenomena that cannot be empirically verified. This section comprised seven statements. The responses to these statements suggest that accountants are not aware that accounting measurement is created from phenomena that cannot be empirically verified. It has been established in this study that all measurements should be objective. The findings in this section suggest that accountants are not able to distinguish between measurement and quantification. It could also be concluded that accountants do not know what measurement is.

14.2.2.5 Measurement and the concept of time under the accounting conceptual framework

This section tested whether accountants are aware that measurement only occurs in the present. This section consisted of seven statements. The responses to these statements indicate that accountants are not aware that measurement only occurs in the present. Only phenomena that can be empirically verified are measurable, and only reality is measurable. This indicates that accountants are not familiar with the principles of representational measurement.

14.2.2.6 The principles of representational measurement

This section examined whether accountants are familiar with the general principles of representational measurement. This section consisted of eight statements. The response to one of the eight statements indicates that accountants are not familiar with the concept of error. They do not realize that an empirically true value of a measured quantity does not exist. Responses to the other seven statements in this section indicate a general familiarity with the basic principles of the representational theory of measurement. It may be concluded that, even though accountants revealed a general familiarity with the principles of the representational theory of measurement in this section, on the whole accountants need to be schooled in the art of representational measurement.

In conclusion, it is evident from the empirical research that accountants are not familiar with the principles of the representational theory of measurement. Furthermore, accountants do not know how to apply the principles of this theory. Accounting can never be a measurement discipline unless accountants who perform the process of measurement understand the principles of the representational theory of measurement. In addition, research efforts should concentrate on describing accounting, as it is a non-measurement discipline that utilizes numbers to describe economic situations.

14.3 Limitations of the study

It should be pointed out that it is not possible to cover all the aspects of a particular field of enquiry in a single study. In chapter 1 and 11, the delimitations of this study were set out. In the sections that follow here, the aspects of literature that were not covered and the shortcomings of the empirical component of this study are highlighted. The identification of the limitations of this study is important, as this will identify priorities for future research.

14.3.1 Limitations in terms of the theoretical component

- The study focused on uni-dimensional measurement. Some examples of accounting phenomena, in particular value and income, are multi-dimensional. This means that the concept of multi-dimensional measurement should be explored in order to understand the measurement of the concept of value.
- The study applied the principles of the representational theory of measurement to the accounting principles of the IASB framework (2006) for financial reporting and the International Accounting Standards 1. The principles of the representational theory of measurement have not been applied to the other numerous International Accounting Standards outlined by the IFRS (2006). It is therefore necessary to apply these principles to each individual accounting standard in order to determine whether these standards are in harmony with the principles of the representational theory of measurement.
- The study focused on the principles of the IASB framework (2006) for financial reporting. There are numerous conceptual frameworks in accounting. It is also necessary to apply the principles of the representational theory of measurement to the accounting measurement

principles in these conceptual frameworks in order to determine whether they are in harmony with the principles of the representational theory.

14.3.2 Limitations in terms of the empirical component

Survey research was conducted to supplement the theoretical component of the study. Although the research was exploratory in nature, a quantitative approach was followed. The motivation behind this was to obtain as wide a range of perspectives as possible, not in-depth information. The decision was based on the fact that no similar research has been conducted to capture the intuition of accountants regarding the principles of measurement.

One of the major drawbacks of the empirical component of this study is that, to the knowledge of researcher, no other research of this nature has been conducted before. As a result, it is difficult to know how well this type of questionnaire captures the intuition of accountants into the concept of representational measurement.

An Internet-based questionnaire was used. It is usually easier and less time-consuming to manage the data collection process with an electronic questionnaire. The questionnaire was emailed to the accounting departments of companies that listed on the Johannesburg Stock Exchange. However, the response rate was low. This may be due to the fact that in top companies, executives are frequently requested to complete questionnaires. As a result, some companies (see appendix B) have now decided against participating in surveys. Company policy also prevents them from participating in some cases.

The questionnaire used in this study was directed at chartered accountants. These are members of the South African Institute of Chartered Accountants. However, this institute does not issue addresses and contact details of its members to researchers. As a result, questionnaires were sent to those chartered accountants working in companies that are listed on the Johannesburg Stock

Exchange whose addresses could be found in the annual reports, and to those chartered accountants working at universities whose addresses could be found on university websites. Owing to this problem, it was not possible to send out as many questionnaires as the researcher would have wished.

14.4 Contributions to research

This study has made several mainline contributions to accounting. These are the following:

- It identifies, through an interdisciplinary literature survey, the major challenges confronting the accounting discipline and accountants in adapting the principles of representational measurement to accounting.

These challenges have been identified as:

-The lack of clearly specified goals of measurement in accounting. The concept of measurement presupposes the achievement of a goal. This goal must be clearly specified for measurements to have any significance.

-The lack of clearly defined and identifiable attributes that can be measured in accounting. The concept of measurement requires that the attributes that are being measured must be empirically identifiable. The properties of these attributes must be empirically testable. The accounting literature identifies cost and value as attributes that must be measured in order to facilitate the preparation of financial statements. However, both cost and value are not properly defined in accounting. There are no specified properties that can be used to empirically identify cost and value. Unless the empirical properties of cost and value are specified they cannot be measured.

- The concept of a scale is currently misapplied in the accounting discipline. The concept of measurement requires a scale of measurement that can be used to distinguish the extent to which a particular object possesses a specified property. In the accounting

discipline, the property that is being measured is the value of an element of the financial statements. But there are no specified scales of value that can be used to identify the extent to which a particular element of the financial statement possesses value. In the accounting discipline, the concept of value is currently believed to be measured on a ratio scale. But in this discipline there is no specified property of value the measurement of which can give rise to extensive measurement.

- The current belief in the accounting discipline that monetary units are a measure of value is false. Accountants generally believe that the amount of monetary units in financial statements is a measure of the value. The concept of representational measurement requires that the relationship between the object being measured and the abstract structure used to measure it be specified. In the accounting discipline, however, the relationship between monetary units and value is not known. The amount of monetary units in the financial statements is a measure of the numerosity of monetary units and not value.
- Accountants do not have an adequate knowledge of measurement. Accountants are supposed to carry out the task of measurement in accounting: they are believed to be the agents of measurement. But accountants do not have an adequate knowledge of the principles of measurement. Consequently, steps should be taken to educate accountants on the principles of measurement.
- Making the principles of representational measurement popular to accountants. These principles were developed by Scott and Suppes (1958). This is a theory that establishes measurement in the social sciences. Accounting is a social science. The recent history of the principles of the representational theory of measurement has made these principles very new to most disciplines. Their use in this thesis will help to make the theory popular with accountants.

- The study proposes procedures that accountants need to follow in order to produce representational measurements.
- The study gives an appropriate classification to numerical assignments in accounting. Current accounting numerical assignments are classified as measurements. However, numerical assignments in accounting are not measurements as they fall short of the requirements of measurements. They are in fact indicants.
- The study highlights the fact that the principles of measurement have been included in the accounting discipline prior to a thorough understanding of their true mathematical meaning and implications for the accounting discipline. Power (1994) notes that the empirical stature of a science is determined by its use of the principles of measurement. Therefore, the claim by the accounting discipline that it is a measurement discipline implies that it is an empirical science. However, this study reveals that accounting is not an empirical science and that the principles of measurement are misused in the accounting discipline.

14.5 Further research

During the study a number of areas requiring further research were identified:

- Two phases of the Mitroff model have not been completed in this thesis:
 - Phase 3, “scientific model”, was not attempted other than by way of attempting to introduce the principles of the representational theory of measurement to accounting. Building a scientific model of accounting measurement would involve a proper definition of the qualitative structure of the objects in accounting whose attributes are of interest to measure. It is also necessary to specify the attributes of the qualitative structure, the specification of the relations among the attributes of the qualitative structure, the selection of an abstract structure that could be used to represent the empirical relational structures of accounting phenomena and the specification of homomorphisms.

Empirical research can then be conducted to establish whether the scientific model corresponds with the reality problem situation in phase 1.

-Phase 4, “Solution”, was not attempted in this thesis. This involves finding and implementing a solution to the reality problem situation. However, extensive research is required to develop the accounting concept of measurement based on the representational theory of measurement. Only once this has been accomplished will the possibility of converting the scientific model into a practical solution and implementing it be considered.

14.5.1 Important research topics

The concept of measurement has not been properly explored in the accounting discipline. This is indicated by the lack of success of accounting researchers in creating a theory of measurement from their observation of accounting measurement practices. Furthermore, this study has revealed that accounting is not a measurement discipline. As a result, this has provided many opportunities for future research into accounting measurement. The following recommendations for future research are made:

- Research into the identification of attributes of accounting phenomena that are of use and interest to measure in accounting.
- Research that leads to the creation of a theory of accounting measurement from accounting measurement practices.
- Research to find out what the monetary units in the financial statements represent.
- The application of the principles of multidimensional measurement in the measurement of value. Value is considered a multidimensional concept in this study. In order to conduct future research it will be necessary for the researcher to understand mathematical material (Luce *et al.*, 1971, 1989, 1990) on sets, relations, functions, probability, topology, abstract algebra, calculus and geometry.

- Applying the concept of topology to accounting value. Research into the topological properties of linearly ordered spaces of value may provide insight into which scales of measurement the value space admits. In order to conduct this kind of research it is essential that the researcher be familiar with mathematical material on sets, relations, functions, probability, topology, abstract algebra and calculus.
- Making Accounting Standards compatible with the principles of the representational theory of measurement.
- Research into the relationship between the concept of measurement and benchmarking
- Creating a scientific model of accounting measurement based on the principles of the representational theory of measurement.
- Making the preparation and presentation of financial statements compatible with the principles of the representational theory of measurement.
- Axiom systems, other than extensive systems, have been developed in the social sciences as a basis for fundamental measurement. These include difference measurement, conjoint measurement, and expected utility measurement (Luce *et al.*, 1971:124). Since accounting is a social science, investigating whether one of these measurement systems could be useful in accounting is an area of worthy of research (Orbach, 1978). In order for the researcher to apply the principles of difference measurement, conjoint measurement, and expected utility measurement to accounting, Luce *et al.* (1971) recommend that he or she has a thorough understanding of the mathematical principles of sets, relations, functions, probability, topology, abstract algebra and calculus. If this is not done, it might be necessary to conduct research in order to change the perspective of accounting from a measurement discipline to one that uses indicants as its primary source of medium in the communication of financial information.

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Appendix A



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**Faculty of Economic and
Management Sciences**

Department of Financial Management

Consent for participation in an academic research study

Applying the Representational Theory of Measurement to Accounting

Questionnaire to Accountants

Dear respondent

You are invited to participate in an academic research study conducted by **Sartiel Wedzerai Musvoto**, a doctoral student under the supervision of Professor **Daan Gouws** of the School of Financial Management Sciences at the University of Pretoria.

The concept of measurement is forming an important part of the accounting terminology. Definitions and accounting practice suggest that accounting is a measurement discipline. However, attempts to formulate a theory of accounting measurement have failed.

The purpose of this study is to investigate the accounting concept of measurement by comparing it with the representational theory of measurement (It is a theory of measurement that establishes measurement in social sciences).

The statements in the questionnaire comprise mostly of statements about measurement deducted from the principles of the representational theory of measurement, and statements made by other researchers extracted from accounting and trans- disciplinary

literature. In some cases accountants might not be familiar with the principles of the representational theory of measurement being tested.

The responses obtained from the individual questionnaires aimed at the accountants will be analysed and statistically processed into final results. The information from the respondents will at all times be treated as confidential and will not be made available to any entity or third parties. Neither your name nor your company will be linked to your contributions to this study. The data obtained from the questionnaires will be used for academic research purposes only.

Your participation in this study is very important. You may, however, choose not to participate and you may also stop participating at any time without any adverse consequences.

An electronic copy of the final research study will be made available to all participants in this study as soon as the research is completed.

Please complete the questionnaire electronically if possible, which should take approximately 10 to 15 minutes, and return it via e-mail as an attachment or fax or post the completed questionnaire as quickly as possible the address below.

Should you require any further information, please do not hesitate to contact **Sartiel Wedzerai Musvoto** at:

Telephone: 0782361398
 Fax: 013 665 5511
 E-mail: swmusvoto@gmail.com
 Postal address: P.O. Box 3953
 Botleng
 Delmas
 2210

Your responses to the enclosed questionnaire would be greatly appreciated. Thank you in anticipation for your kind cooperation and assistance with this research project.

Yours Sincerely
 Sartiel Wedzerai Musvoto

I understand that the information I provide will only be used for the purposes of this research project and that I will remain anonymous. I confirm having participated under informed consent.	Please Tick
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------



Consent: I give my permission for the use of information I provide below to be used for research purposes (which will not in any way be to my disadvantage or detriment)	Yes	No

Your participation is very important. However, you may at any point during the survey cease your participation without being adversely affected. Please confirm that you are aware of this.

Please Tick all the appropriate boxes. As an Accountant, I fall into the following category:	Category	Please Tick	Official
	Academic		
	Chartered Accountant		

Questionnaire for accountants to determine whether the concept of measurement forms part of the traditional accounting methodology

The following rating Scale is used:

- S/D** Strongly disagree
- D** Disagree
- U** Unsure
- A** Agree
- S/A** Strongly Agree

NB: First read through all the statements carefully and then answer using an **x** to indicate your choice in each case.



		1	2	3	4	5
		S/D	D	U	A	S/A
1. Measurement in the accounting conceptual framework context						
1	The accounting conceptual framework provides a foundation that sets the objectives and concepts that underlie the measurement of the attributes of economic phenomena.					
2	Information is understandable and useful to users if it possesses the quality of meaningfulness.					
3	Accounting information is relevant to the economic-decision making needs of the users if it is meaningful to the users.					
4	Reliable information is information that can be empirically verified.					
5	The comparability of accounting information is possible when the conditions of comparability are specified.					
2. Measurement and the nature of accounting phenomena under the conceptual framework						
6	The future economic benefits that are expected to flow from an asset are measurable					
7	Liabilities have measurable attributes					
8	Under the accounting conceptual framework it is possible to measure the income generated by an entity in a particular accounting period.					
9	The attributes of expenses are measurable					
10	It is possible to measure the attributes of future events					
3. Measurement and the recognition of accounting phenomena						
11	An item that meets the definition of an element of the financial statements should be recognized if the item has a cost or value that can be measured with reliability.					
12	<i>Valuation is a process that is similar to measurement</i>					
13	Value determinations continually refer to future states.					
14	Historical cost basis, current cost basis, realisable value basis, the present value basis and the fair value basis are theories of measuring value					
15	The amount of monetary units paid to acquire a commodity is a measure of its value.					

		1	2	3	4	5
		S/D	D	U	A	S/A
4. The integrity of accounting information created under the accounting conceptual framework						
16	Future events do not represent reality.					
17	Estimates in accounting reflect measurements of the attributes of economic transactions					
18	Accrual accounting is mainly concerned with the measurement of the attributes of future accounting phenomena.					



19	Income is an ambiguous concept, and it is not an intrinsic property of an accounting entity (phenomenon).					
20	Value is an ambiguous concept, and it is not an intrinsic property of an accounting entity (phenomenon).					
21	The attributes of accounting phenomena are dependent on the judgement of the accountant.					
22	Value is whatever two people are willing to trade for.					
5. Measurement and the concept of time under the accounting conceptual framework						
23	The going concern assumption is necessary for accounting measurement to occur					
24	It is possible to measure periodic income under the going concern assumption.					
25	Under the going concern assumption the statement of financial position reflects true measurements of the attributes of assets and liabilities					
26	The valuation of assets and liabilities can only occur under the going concern assumption					
27	The values of assets can be meaningfully added to each other in the balance sheet					
28	The values of the items of income in the income statement can be meaningfully added to and subtracted from each other.					
29	The income generated by cash sales and credit sales can be meaningfully added to each other.					
6. The principles of representational measurement						
30	Measurement refers to any method of assigning numbers to represent properties or qualities, according to some set of rules.					
31	Measurement is a relative matter (it varies in kind, degree, type and precision).					
32	Every measurement system requires the specification of a scale of some kind.					
33	An empirically true value of a measured quantity does not exist.					
34	Measurement requires the specification of a property to be measured.					
35	Every measurement system requires the specification of a unit in the scale (e.g., Rands, kilogram, etc).					
36	Measurement should take place under specified conditions					
37	In a measurement discipline, the property to which numbers will be assigned must be measurable.					

Appendix B

Responses of companies not prepared to partake in the survey.

Not all companies were prepared to partake in the survey. Some responses received read as follows:

“I am unable to answer the questions because they are not neutral and seem to be based on a particular view of the world. You talk as if there is a single accounting conceptual framework. It is doubtful if there is one at all, but there may be several depending on your point of view. Thus, I think your survey is biased by virtue of the language it employs and so I am unable to respond to the questions that seem to me to be based on a particular view of the world”.

“I regret do not find your survey to reflect current theoretical ideas, and certainly feel I cannot meaningfully answer your questions. I wonder if you have read any of the philosophical literature on representation and measurement (e.g. Rorty) or accounting papers on representation such as Hines (AOS, 1988) and Tinker (AOS, 1991). Or papers by Vollmer in CPA (2005) and AOS (2007). All have extensive reference lists”.

“The study you are conducting is noted with interest. However, we are being in audited with questionnaires of this nature issued by educational authorities, organizations doing research and postdoctoral students over and above the compulsory questionnaire issued by government departments. These questionnaires all require the attention of senior personnel and we found that too much time of

senior officials would be taken up if these questionnaires were all to be replied to. It would also be an invidious and in fact an impossible task to make a selection according to merit and importance. In view of the foregoing it has been decided not to participate in the studies requiring the attention of senior officials and we consequently regret that that your request to complete the questionnaire can unfortunately not be met”.

“Your request for the completion of a questionnaire in the above regard has reference. Regretfully I must decline your invitation to participate. My knowledge of the issue under review is so scant that I really will not be able to contribute anything significant. May I however, take this opportunity to wish you everything of the best in your studies “.

“As you will appreciate, our company receives numerous requests to participate in questionnaires and surveys. As a consequence, we are unable to respond to them individually”.