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 contexualize 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 Ri and possibly a collection of functional elements – operations oi – 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

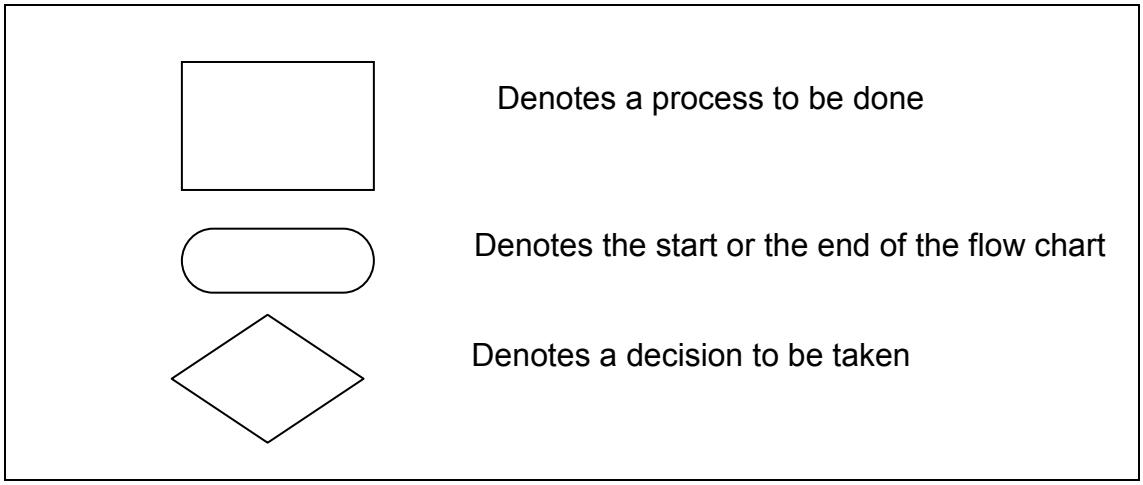
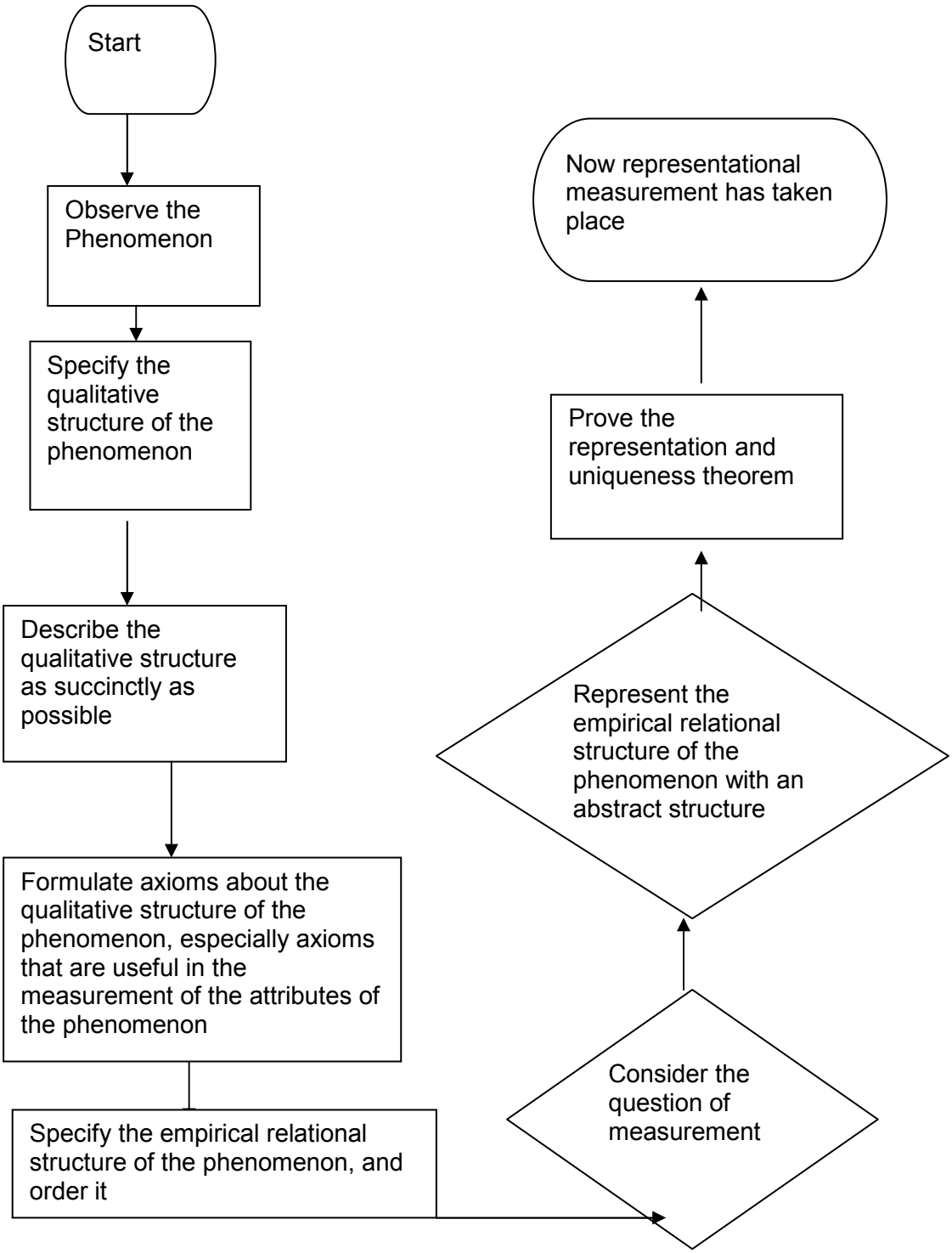


Figure 13.21 Flow chart depicting the process of representational measurement



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 is 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.

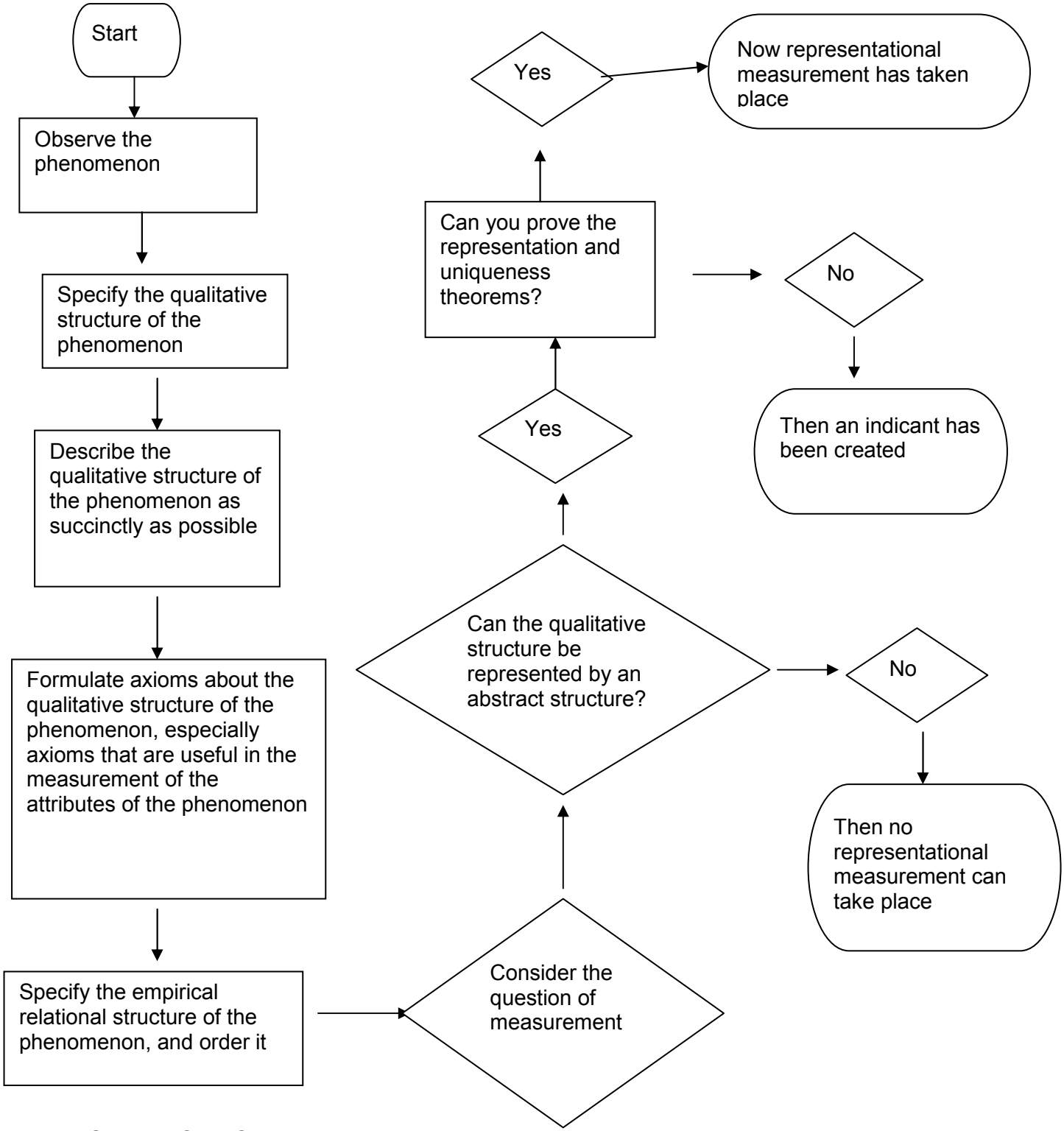
In chapter 6 it was established that measurement only occurs when the relationship between the indicant and the dimensions of the entity in question are known. Stevens (1951) also argues that the difference between an indicant and a measure is that the indicant is a presumed effect or correlate that 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.

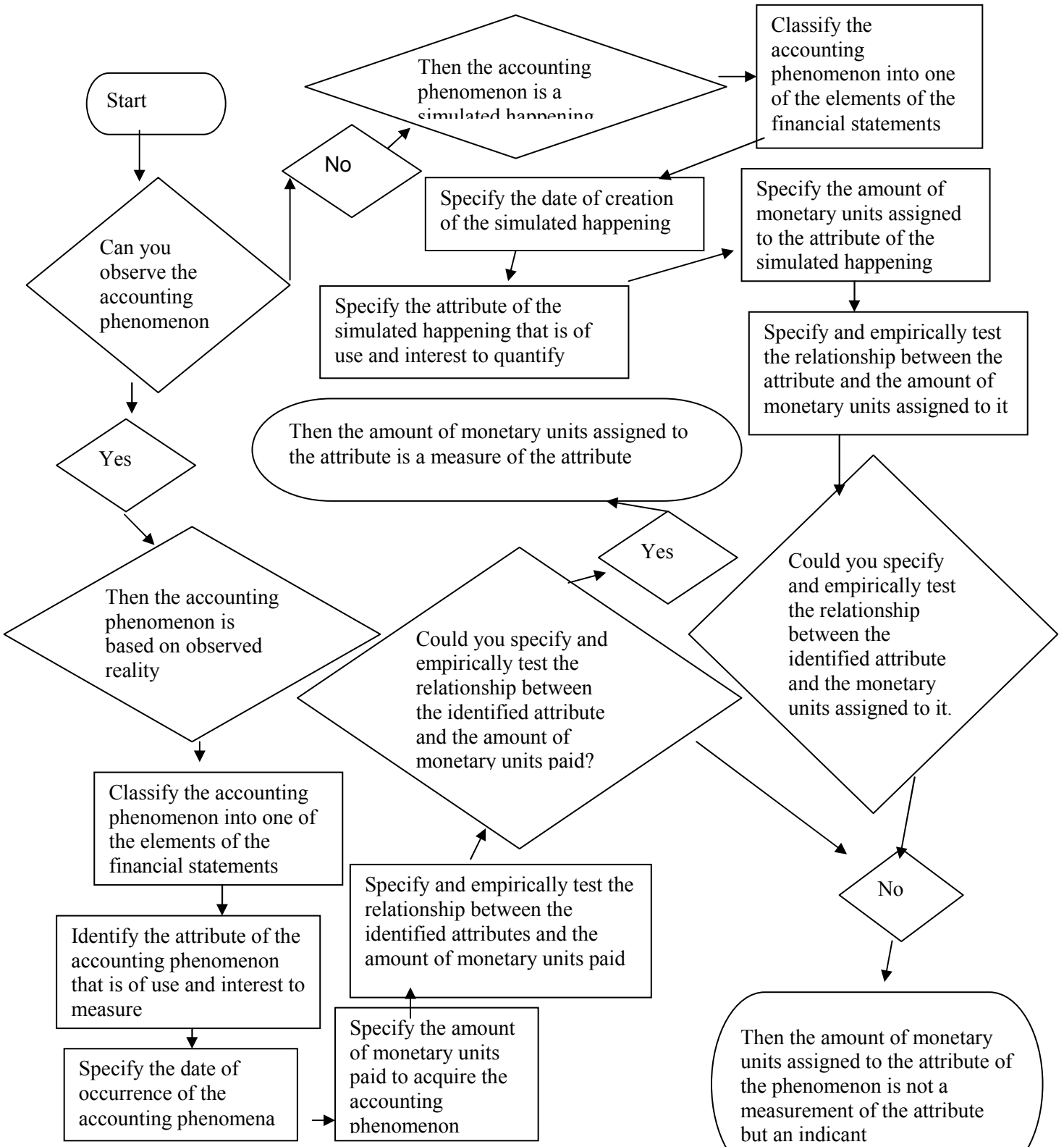
If this is the case, it follows that accounting should not be referred to as a measurement discipline. Furthermore, accountants need to be educated in the concept of representational measurement. In chapter 6, it was established that the bases of accounting measurement (historical cost, current cost, 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 no 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. Indicants 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 and11, 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.