

The Conceptual Framework for Financial Reporting Represented in a Formal Language

by

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15 September 2015

DECLARATION

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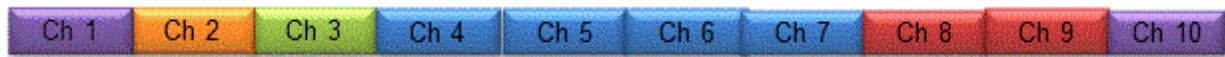
ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AAA	American Accounting Association
AAPA	American Association of Public Accountants
AIA	American Institute of Accountants
AICPA	American Institute of Certified Public Accountants
AIISG	Accountants International Study Group
APB	Accounting Principles Board (United States Of America)
ASCPA	American Society of Certified Public Accountants
ASB	Accounting Standards Board (United Kingdom)
ASC	Accounting Standards Committee (United Kingdom), from 1976 onwards
ASSC	Accounting Standards Steering Committee (United Kingdom), until 1976
CAP	Committee on Accounting Procedure (United States of America)
THE CFFFR	The Conceptual Framework for Financial Reporting (Published by the IASB in September 2010)
CICA	Canadian Institute of Chartered Accountants
DL	Description Logics
DSR	Design Science Research
ED	Exposure Draft, of the ASC or IASB
EU	European Union
FCAG	Financial Crisis Advisory Group
FAF	Financial Accounting Foundation (Overseeing the FASB)
FAS	Financial Accounting Standards
FASAC	Financial Accounting Standards Advisory Council
FASB	Financial Accounting Standards Board (United States)
FCAG	Financial Crisis Advisory Group
FEDS	Framework for Evaluation in Design Science
FIFO	First-In, First-Out (Inventory Flow)
FRS	Financial Reporting Standard (of the ASB)
GAAP	Generally Accepted Accounting Principles
GLOBAL CFFFR	A Globally Acceptable Conceptual Framework for Financial Reporting
GO	Gene Ontology
IAS	International Accounting Standard(S)
IASB	International Accounting Standards Board (Successor to the IASC)
IASC	International Accounting Standards Committee
IBA	The Institute of Bookkeepers and Accountants
ICAEW	Institute of Chartered Accountants in England and Wales
IDEAL CFFFR	An imagined ideal Conceptual Framework for Financial Reporting
IFRS	International Financial Reporting Standard
IS	Information Systems
NYSE	New York Stock Exchange
OBO	Open Biomedical Ontologies
OLC	Ontology Life Cycle

ABBREVIATION	DESCRIPTION
OMG	Object Management Group
OWL	Web Ontology Language
SAICA	South African Institute of Chartered Accountants
SATTA	A Statement on Accounting Theory and Theory Acceptance
SEC	Securities and Exchange Commission (United States Of America)
SNOMED CT	Systematised Nomenclature of Medicine -- Clinical Terms
SUS	System Under Study
W3C	World Wide Web Consortium
WWW	World Wide Web
XBRL PROJECT	Extensible Business Reporting Language Project

DEFINITION OF TERMS

TERM	DEFINITION
Artefact	<i>Constructs</i> (vocabulary and symbols), <i>models</i> (abstractions and representations), <i>methods</i> (algorithms and practices), and <i>instantiations</i> (implemented and prototype systems) (Hevner, March, Park, & Ram, 2004:77).
Class	Collection of instances.
Formal ontology (in AI)	An explicit specification of a conceptualisation (Gruber, 1993).
Formal language	A language designed for use in situations in which natural language is unsuitable, as for example in mathematics, logic or computer programming.
Ontology (in philosophy)	The word ontology is used to refer to philosophical investigation of existence, or being. Such investigation may be directed towards the concept of 'being', asking 'what being means', or what it is for 'something to exist'; it may also (or instead) be concerned with the question 'what exists?', or 'what general sorts of thing are there?' (Craig, 1998)
Ontology of financial reporting	A theory of the most general structure in the form of a systematic account of the nature of being, kinds of things and structures of objects, properties, events, processes and relationships in every area that have existence in financial reporting.
Ontolingua	Is a mechanism for writing ontologies in a canonical format, such that they can be easily translated into a variety of representation and reasoning systems? This allows one to maintain the ontology in a single, machine-readable form while using it in systems with different syntax and reasoning capabilities (Gruber, 1992:1).
Phenomenology	Phenomenology is the study of structures of consciousness as experienced from the first-person point of view.
Relationship	The way in which two or more classes, concepts, objects or people are connected, or the state of being connected.
Semantic domain	An area of human knowledge exhibiting specific terminology and lexical coherence, a cognitive category. A specific area that shares a set of meanings, or a language that holds its meaning, within the given context of the area.



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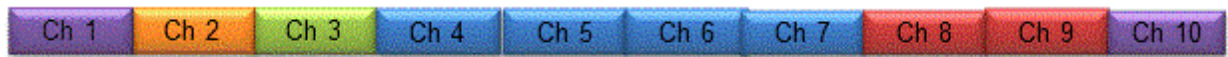


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ABSTRACT

The objective of this thesis is to investigate how the use of ontology technologies, as utilised in computing, can contribute towards formulating a globally acceptable Conceptual Framework for Financial Reporting (global CFfFR).

The ideal being pursued in the financial reporting domain is a single set of high quality, principle-based accounting standards which are globally recognised (Barth, 2013b; Bullen & Crook, 2005; Stein, 2015) guiding the provision of decision-useful information to the users of financial reports (IASB, 2010a). The CFfFR, published by the International Accounting Standards Board (IASB) (IASB, 2010a), was developed with the intention to provide guidance to users and preparers of financial reports and standard setters regarding the provision of decision-useful financial information (IASB, 2010a). Unfortunately, a clear, consistent and unambiguous world is not the reality, which preparers of financial reports and investors encounter when they compile and interpret financial reports governed by financial accounting standards (Bhimani, 2008; Schipper, 2003; Tweedie, 2007; Wüstemann & Wüstemann, 2010).

This is a multi-disciplinary study, involving mainly the disciplines of accounting and computing, but also touching on philosophy and the philosophy of science. The multi-method qualitative study was performed adopting a research strategy utilised in the Information Systems (IS) discipline known as Design Science Research (DSR) (Vaishnavi & Kuechler, 2013).

Three research techniques were used during the performance of the DSR Cycles. The research techniques were used to answer the three sub-research questions and finally the main research question. A systematic review was performed during DSR Cycle 1. DSR Cycles 2 and 3 involved interdisciplinary investigations, combining knowledge from philosophy, philosophy of science and computing to enhance knowledge in the main discipline i.e. accounting.

The main research question was answered during DSR Cycle 4, when a domain ontology of the CFfFR was modelled. The CFfFR was modelled using the Ontology Life Cycle (OLC) (Neuhaus, Vizedom, Baclawski, Bennett, Dean, et al., 2013) developed in the knowledge representation (computing) discipline.

Part of the findings was that it is possible to build a formal domain ontology of the CFfFR. The main contributions were made during the performance of DSR Cycle 4 (Chapter 7). A formal domain ontology of the CFfFR as artefact provided the most basic classes and relationships to facilitate decision-useful information. During the formalisation process, inconsistencies and unintended meanings within the CFfFR were identified. In conclusion, some areas for further research were identified.

SAMEVATTING

Die doel van hierdie tesis is om die daarstelling van 'n ideale en wêreldwyd-aanvaarbare Konseptuele Raamwerk vir finansiële verslaggewing (globale CFfFR) te ondersoek, en meer spesifiek, hoe die gebruik van ontologie tegnologie, soos toegepas in die rekenaarwese, tot die formulering van so 'n CFfFR kan bydra.

Die ideaal wat in die finansiële verslaggewing domein nagestreef word, is 'n enkele stel hoë gehalte, – beginsel gebaseerde rekeningkundige standaard wat wêreldwyd erken word (Barth, 2013b; Bullen & Crook, 2005; Stein, 2015) en wat as 'n gids kan dien vir die voorsiening van inligting wat nuttig is vir besluitneming deur die gebruikers van finansiële verslae (IASB, 2010a). Die huidige CFfFR, gepubliseer deur die International Accounting Standards Board (IASB) (IASB, 2010a), is ontwikkel met die doel om leiding te gee aan die gebruikers en formuleerders van finansiële verslae en standaardstellers, spesifiek rakende die voorsiening van finansiële inligting (IASB, 2010a) wat nuttig tydens besluitneming is. Tans vind opstellers van finansiële verslae en beleggers nie hierdie duidelike, konsekwente en ondubbelsinnige werklikheid wanneer hulle finansiële verslae volgens die bepalinge van finansiële rekeningkundige standaard opstel en interpreteer nie (Bhimani, 2008; Schipper, 2003; Tweedie, 2007; Wüstemann & Wüstemann, 2010).

Hierdie is 'n multi-dissiplinêre studie wat hoofsaaklik die dissiplines van rekeningkunde en rekenaarwese betrek, maar wat ook filosofie en die filosofie van die wetenskap betrek. Die multi-metode kwalitatiewe studie is uitgevoer deur middel van die aanneming van 'n navorsingstrategie wat gebruik word in die Inligtingstelsels (IS) dissipline en wat bekend staan as Ontwerpswetenskap Navorsing (OWN) (Vaishnavi & Kuechler, 2013).

Drie navorsingstegnieke is tydens die uitvoer van die OWN Siklusse gebruik. Die navorsingstegnieke is gebruik om die drie sub-navorsingsvrae en uiteindelik die hoof navorsingsvraag te beantwoord. 'n Sistematiese oorsig is uitgevoer tydens OWN Siklus 1, OWN Siklus 2 en 3 het interdissiplinêre ondersoek en 'n kombinasie van kennis soos afgelei van filosofie, filosofie van die wetenskap en rekenaarwese met die doel om kennis te verbreed by die hoof dissipline, m.a.w. rekeningkunde, betrek.

Die hoofnavorsingsvraag is tydens OWN Siklus 4 beantwoord. In OWN Siklus 4 is 'n domein ontologie van die CFfFR ontwikkel. Die CFfFR-ontologie is met behulp van die Ontologie Lewensiklus (OLS) (Neuhaus, Vizedom, Baclawski, Bennett, Dean, et al., 2013) ontwikkel.

Deel van die bevindinge is dat dit moontlik is om 'n formele domein ontologie van die CFfFR te bou. Die hoofbydraes is tydens die uitvoering van OWR Siklus 4 (Hoofstuk 7) gemaak. 'n Formele domein ontologie van die CFfFR as artefak verskaf die mees basiese klasse en verhoudings om inligting nuttig vir besluitneming te fasiliteer. Gedurende die formaliseringsproses is teenstrydighede en onbedoelde betekenis binne die CFfFR geïdentifiseer. Ten slotte, is gebiede vir verdere navorsing geïdentifiseer.

CHAPTER 1

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1 INTRODUCTION

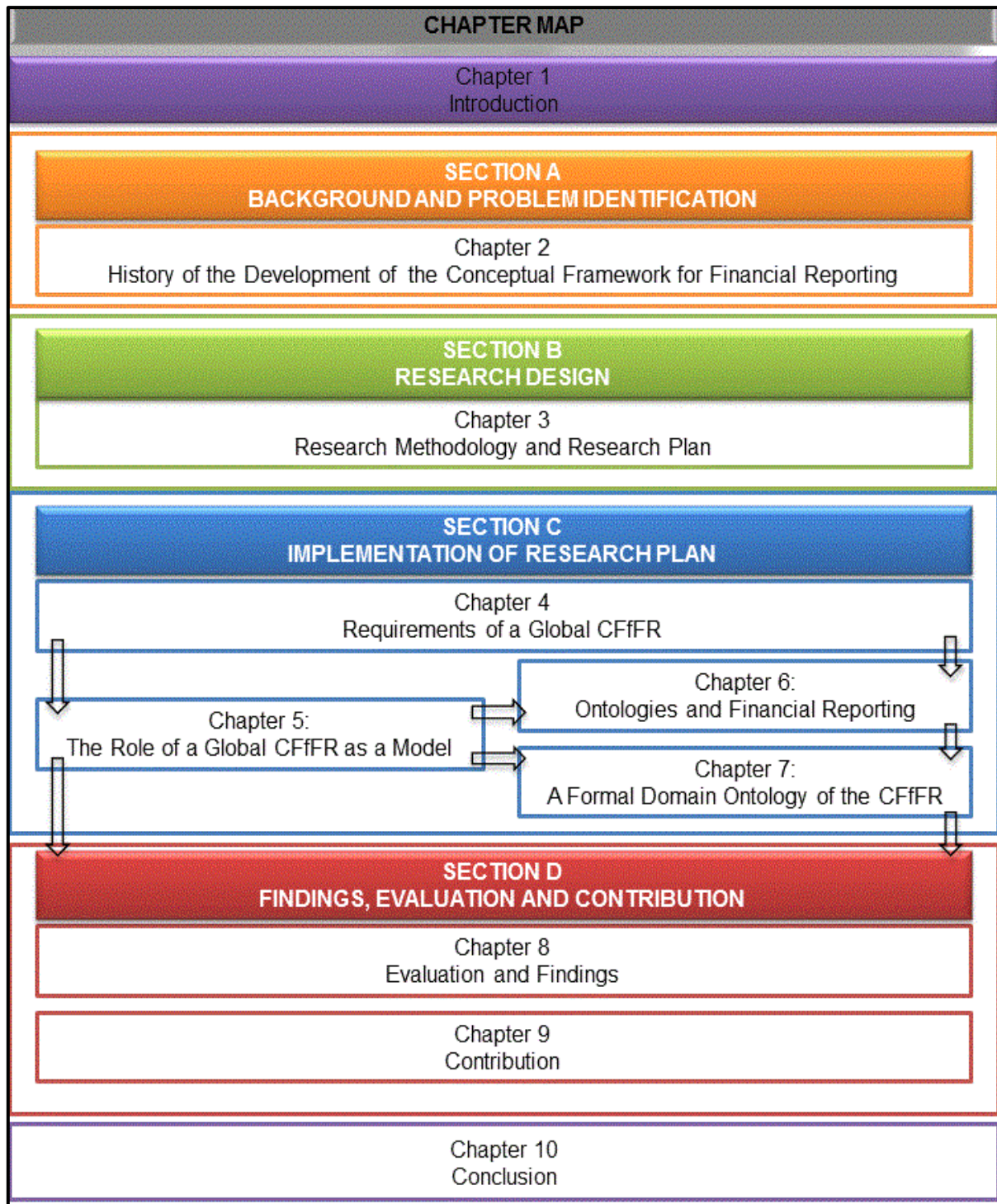


Figure 1.1: Chapter map – Chapter 1

1.1 Introduction

The objective of this thesis is to investigate how the use of ontology technologies, as utilised in computing,¹ can contribute towards formulating a globally acceptable Conceptual Framework for Financial Reporting (global CFfFR). The ideal being pursued in the financial reporting domain is a single set of high quality, principle-based accounting standards which are globally recognised (Barth, 2013b; Bullen & Crook, 2005; Stein, 2015) guiding the provision of decision-useful information to the users of financial reports (IASB, 2010a). The CFfFR, published by the International Accounting Standards Board (IASB) (IASB, 2010a), was developed with the intention to provide guidance to users and preparers of financial reports and standard setters regarding the provision of decision-useful financial information (IASB, 2010a). Unfortunately, a clear, consistent and unambiguous world is not the reality, which preparers of financial reports and investors encounter when they compile and interpret financial reports governed by financial accounting standards (Bhimani, 2008; Schipper, 2003; Tweedie, 2007; Wüstemann & Wüstemann, 2010).

Since the CFfFR was developed with the purpose to provide guidance with setting accounting standards that are globally recognised, it is evident that the CFfFR itself should be accepted globally to fulfil its intended purpose. Such a global CFfFR does not exist, as the Financial Accounting Standards Board (FASB) in the U.S. and the IASB use different conceptual frameworks for guidance to set accounting standards.

The predicament on how to develop a global CFfFR can be described as a wicked problem because it involve unstable requirements and constraints within a complex interaction (Hevner et al., 2004) not only between different stake holders such as legislators, domain experts, practitioners and academics, but also between different disciplines (section 3.6). Design Science Research (DSR) in computing addresses research problems that are considered to be wicked problems (Hevner et al., 2004).

In order to determine how the use of ontology technologies can contribute towards formulating a global CFfFR, a DSR strategy is followed combining knowledge from different disciplines. From philosophy, knowledge regarding ontology is acquired to understand the importance of logic and formal languages as utilised in ontology technologies and its contribution towards formulating a possible global CFfFR. From philosophy of science, a model theory proposed by Mäki (2009) is adopted and adapted to explain the value of an ideal CFfFR that is based on idealised assumptions. The utilisation of the idea of an ideal CFfFR demonstrates how a CFfFR ontology can serve as a truth bearing model in the quest for a global CFfFR. Knowledge regarding the use of conceptual models, metamodels and meta-metamodels in computing (Henderson-Sellers, 2011b; Kühne, 2005; Kühne, 2006a), the Object Management Group (OMG) model hierarchy (OMG, 2014), and ontologies in computing (McGuinness, 2003; Guizzardi, 2006; Guarino, 1997) are applied to the financial reporting domain during the investigation. The knowledge obtained from

¹ Computer Sciences and Information Systems are disciplines within *computing*. *Computing* is used to refer to both.

these disciplines are combined to investigate how the use of ontology technologies (Neuhaus et al., 2013; Smith, 1998), can contribute towards formulating a global CffFR.

1.2 Background

The history and some of the mechanisms used to develop the CffFR and accounting standards (as indicated in Chapter 2), often resulted in vagueness, inconsistencies and ambiguities (unintended meanings) in the CffFR and financial accounting standards (FASB and IASB, 2002; IASB, 2013a; Wüstemann & Wüstemann, 2010). Incompleteness, inconsistencies, unintended meanings and outdated principles and postulates in the CffFR are presented as some of the reasons to revise the CffFR (FASB and IASB, 2002; IASB, 2013a; IASB, 2014a).

The need for globally accepted financial accounting standards is widely recognised (Tweedie, 2007; Camfferman & Zeff, 2009; Hail, Leuz, & Wysocki, 2010). The need arose because of the integrated nature of the global economy, which has its roots in the time after World War II with the formation of multinational corporations (FASB, 2014a; Camfferman & Zeff, 2009).

The accounting world officially reacted to the increasingly integrated World economy more or less a decade after World War II when Jacob Kraayenhof, as president of The Seventh International Congress of Accountants in 1957, issued a challenge to the American Institute of Certified Public Accountants (AICPA) in his closing speech of the Congress. His challenge was “to invite other countries to set up standing committees for the research and study of accounting principles with a view towards achieving greater international uniformity” (Camfferman & Zeff, 2009).

Many research studies were conducted during the 1960s to search for and formulate accounting postulates and principles (Zeff, 1982). In 1963, Moonitz (1963:46) formulated the need for accounting postulates and principles as follows:

“The formulation of postulates and principles will give accounting the frame of reference, the integrating structure it needs to give more than passing meaning to its specific procedures. It will provide ‘experience’ with the aid it needs from ‘logic’ to explain why it is that some procedures are appropriate and others are not. It will also provide the basis for extensions into new and untried areas with some assurance (at least in logic) that the extensions are sensible and in harmony with the larger framework of accounting.”

However the search for accounting postulates and principles lost some urgency at the end of the 1960s with the idea that it is not possible to have a single set of accounting postulates (Zeff, 1982). The growing international capital market after World War II resulted in some urgency to harmonise accounting practices across the globe. In reaction to the increase of multi-national enterprises, the International Accounting Standards Committee (IASC) was initiated in 1973 to set international acceptable accounting standards (Camfferman & Zeff, 2009).

Due to previous failures to create a single accounting theory, there was some pessimism in 1979 after the publication of SATTA amongst accountants whether it would be possible to create a single accounting theory (Gaffikin, 2008). Despite the pessimism, the IASC recognised in 1979 that a conceptual framework is needed to guide its standard setting process. After an evolutionary development process, the IASC published a conceptual framework (IASB, 1989) that was for the most part based on the SFACs of the FASB.

After the Norwalk Agreement in 2002 (FASB and IASB, 2002) the FASB and IASB initiated the joint conceptual framework project to set a joint conceptual framework that “is sound, comprehensive, and internally consistent” (Bullen & Crook, 2005:1). The commitment made by the FASB and the IASB with the Norwalk Agreement was to develop “high-quality, compatible accounting standards that could be used for both domestic and cross-border financial reporting” (FASB and IASB, 2002:1)

The first phase of the joint conceptual framework project was concluded with the publication of the Conceptual Framework for Financial Reporting (the CFfFR) (IASB, 2010a) on 28 September 2010.

Due to a difference in approach between the FASB and the IASB to complete the CFfFR, the joint conceptual framework project was suspended on 17 November 2010 (FASB and IASB, 2010). The IASB decided during September 2012 to continue with the conceptual framework project without the FASB. Currently the FASB is also continuing with the conceptual framework project according to the phases as identified when the joint project started. Despite the different approaches to the conceptual framework project, both the FASB and the IASB have the **same overall objective** with the project, “to create a sound foundation for future accounting standards that are principles-based, internally consistent and internationally converged” (FASB, 2014b; IASB, 2014b).

If it is the ideal that the accounting standards, based on the conceptual framework, should be principles-based, internally consistent and internationally converged, then the CFfFR should also be principles-based, internally consistent and internationally converged.

However, despite previous attempts by both the FASB and the IASB (and other standard setting bodies), there is to date no conceptual framework for financial reporting that is completely *principles-based, internally consistent and internationally converged*. The fact that there are two different conceptual frameworks for financial reporting as well as that the FASB and IASB are no longer working together on the joint conceptual framework project, is an indication that the respective conceptual frameworks are *not internationally converged*. Examples of *inconsistencies and unintended meanings* in the CFfFR are reported in Chapters 7 and 8. During the analysis and formalisation of especially the definitions of asset, liability and equity as well as the rest of the CFfFR, such inconsistencies and unintended meanings are indicated. Although, based on the work done in the 1960s, it can be accepted that the CFfFR is principle-based, it is *not complete regarding all the concepts (principles)*

required to provide decision-useful information to the users of financial reports (see Chapters 7 and 8) .

1.3 Research Problem

The discussion in Chapter 2, follows a stimulus/response framework (Salvary, 1979) regarding an overview of the historical development of the CFfFR. During the discussion it is indicated how it happened that the CFfFR is not globally accepted although the accounting community is in need of a globally acceptable CFfFR. In Table 2.3 a summary of a stimuli / response pattern of the historical development of the CFfFR is provided. The various stimuli can broadly be summarised under the following classes: political developments, social developments, economic developments, business / reporting requirements and technological developments. Responses from the accounting community related to financial reporting to these stimuli are indicated. It is also indicated how some of the responses contributed to the postulates and principles of financial reporting and were included in the CFfFR.

Some technological developments related to computer technologies such as mainframes, desktop computers, laptops and lately even tablets and cell phones combined with the development of the internet and the world wide web (www) (Berners-Lee, Hendler, & Lassila, 2001; Berners-Lee, 1996) have been prominent since the early 1980s. These developments stimulated responses in accounting such as the eXtensible Business Reporting Language (XBRL) project (Hoffman, 2015; Bonsón, Escobar, & Flores, 2008; Stone, 2005) numerous accounting software packages and business to business transactions over the internet. The internet, via the www, is extensively used to make information regarding standard setting available via the web sites of standard setting bodies. Technological developments related to standard setting are mostly limited to the use of word processing and spread sheet packages. The influence of technological developments in knowledge representation (Brewster & O'Hara, 2007) and artificial intelligence (Garnsey, Nicolaou, & Ponte, 2008; Guizzardi, 2007) on accounting standard setting is limited to a few studies (section 6.4).

In order to help with the improvement of the CFfFR, the research problem addressed in this study is to investigate how it is possible to use recent technological developments in computing, i.e. ontology technologies. A CFfFR ontology was developed using ontology technologies to indicating how the CFfFR can be improved to be closer to the ideal CFfFR. Due to the non-existence of a global CFfFR the research problem identified is how the use of ontology technologies can contribute towards formulating a global CFfFR.

1.4 Research Objective and Research Questions

The research objective, to investigate how the use of ontology technologies can contribute towards a global CFfFR by creating a formal representation of the CFfFR, serves as the overall suggestion according to the DSR strategy. The awareness of the need for a global CFfFR was determined during the discussion on the history of the evolutionary development of the CFfFR in Chapter 2. This serves, in accordance

with the DSR strategy followed in this study, as the main Awareness Step of the study (section 3.6).

The main output of the research project is the development of an artefact in the form of formal representation of the fundamental concepts (classes) and relationships of the financial reporting domain assisting in the provision of decision-useful information to the users of financial reports. The artefact is a formal domain CFfFR ontology (a CFfFR ontology). Formal domain ontologies are used in computing and several other fields to formalise the classes and relationships of a specified domain in an internally coherent and logically consistent manner (McGuinness 2003). During the building process of the CFfFR ontology as well as the evaluation of the CFfFR against the CFfFR ontology it was established how ontology technologies can contribute towards a global CFfFR.

In order to achieve the research objective, the **main research question** to be answered in this study is formulated as follows:

How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

The main research question is answered by posing three sub-research questions. The three sub-research questions are:

- **Sub-research question 1 (SRQ1):** What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research question 2 (SRQ 2):** How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research question 3 (SRQ 3):** How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

The main research question and sub-research questions are designed to address some of the issues that currently prevent the CFfFR from being globally accepted.

1.5 Research Design

This interdisciplinary, interpretative, qualitative study has an abductive approach following a Design Science Research (DSR) strategy using various research

techniques to answer the research questions. The research design, summarised in this section, is discussed in detail in Chapter 3.

The DSR strategy followed in this study was developed for research projects with wicked problem characteristics (Hevner et al., 2004; Hevner & Chatterjee, 2010). A DSR strategy moves through several cycles in order to address a research problem. The DSR strategy in this study follows a main cycle and four sub-DSR cycles (Figure 1.2).

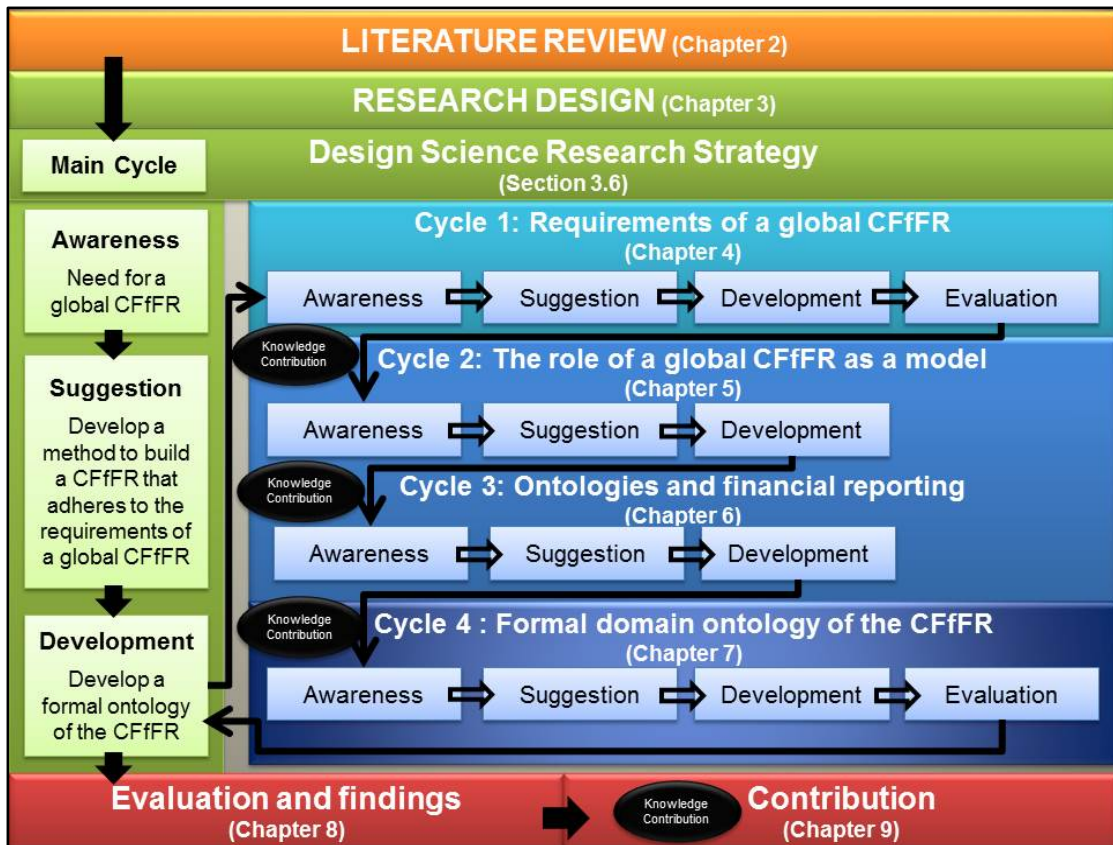


Figure 1.2: DSR as research strategy

During the execution of the four sub-DSR cycles, the three sub-research questions are answered. During the Development Step and Evaluation Step of a cycle, a knowledge contribution is made. This knowledge contribution feeds into the Awareness Step of the next sub-DSR cycle. During the Evaluation Step of the last sub-DSR Cycle the knowledge contributions made during the previous sub-DSR Cycles accumulate to feed into the Development Step, evaluation and findings of the main DSR Cycle. Flowing from the Evaluation Step of the main DSR Cycle the main knowledge contribution of the study is derived.

Benefits of the DSR strategy are that it allows the researcher to build on knowledge obtained during a previous cycle and allows for adjustments during the research process based on new knowledge obtained and additional requirements discovered during the research process. The DSR strategy followed is illustrated in Figure 1.2. Another benefit is that the researcher can utilise different research techniques within

sub-DSR Cycles without contaminating the main research objective and deviating from answering the main research question (Figure 1.2).

Table 1.1 indicates during which cycle of the DSR strategy the research questions were answered.

Table 1.1: Matrix of research questions and DSR strategy

RESEARCH QUESTION	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
MAIN RQ	√				√
SRQ 1		√	√		
SRQ 2			√		
SRQ 3				√	√

As indicated, the main research question is answered by answering SRQ 1 (Chapter 4 and 5), SRQ 2 (Chapter 5), and SRQ 3 in Chapter 6 and Chapter 7.

1.6 Assumptions

An assumption adopted in this study is that the CFfFR contains the fundamental postulates and principles to provide decision-useful information to the users of financial reports. This assumption implies that the knowledge contained in the CFfFR should be sufficient to model the classes and relationships informing the process to publish decision-useful information.

Based on a model theory of Mäki (2009) the assumption is adopted that an ideal CFfFR isolated by untrue but idealised assumptions serves as a truth container. The assumption is that this ideal CFfFR could assist in identifying some truths regarding a global CFfFR (section 5.2) and would contribute towards the extension of knowledge on how to build a global CFfFR.

Certain modeling assumptions were made in order to build a formal domain ontology of the CFfFR. The ontological modeling assumptions are provided in section 7.2.2.

The success of the artefact to answer the main research question is based on the assumption that if the CFfFR ontology (the artefact) complies with more requirements of the ideal CFfFR than the CFfFR, the study indicates how the CFfFR can be improved to be closer to the ideal CFfFR. If the artefact (the CFfFR ontology) complies with more requirements than the CFfFR, it can be accepted that, based on the theory of Mäki (2009), the artefact is a truth container. It can then be concluded that the CFfFR ontology and the procedure to build the CFfFR ontology demonstrate how and where the CFfFR can be improved to function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged.

1.7 Scope, Delineation and Limitation

This study is mainly concerned with the basic postulates and principles of the financial reporting domain. The assumption that the basic postulates and principles are contained in the CFfFR limits the scope to the CFfFR document. The implication of this assumption and limitation is that if a concept or relationship in the CFfFR is not clear from the CFfFR document, it is an indication of an ambiguity (unintended meaning) and is reported as such. An exception to this limitation was necessary with the formalisation of the definitions of asset, liability and equity as it was not possible to avoid inconsistencies without obtaining information from outside the CFfFR. In this case, information was gathered from the discussion paper published by the IASB on the CFfFR (IASB, 2013a).

If essential information is not present in the CFfFR it is viewed as an indication of an incompleteness of the CFfFR. Various cases of incompleteness were identified.

Although the output of the research project is a formal domain ontology of the CFfFR, it does not propose or attempt to provide an alternative CFfFR. Some suggestions are made that could improve the natural text of the CFfFR that may contribute towards the CFfFR being globally more acceptable.

The study also does not claim or pretend to provide a new or alternative accounting theory. The study utilise theories from other disciplines in order to expand knowledge in the financial reporting domain.

1.8 Contributions

The main contribution of the study is the CFfFR ontology (Chapter 7) providing suggestions that could contribute towards formulating a CFfFR that should be more globally acceptable. Other contributions include the identification of requirements (section 4.6) and a definition for a global CFfFR (section 4.7), the role of the CFfFR as a meta-metamodel in the financial reporting domain (section 5.3.5) and the role of the CFfFR ontology within the financial reporting ontology domain (section 6.4). The DSR strategy (Figure 3.3) and the method to develop the CFfFR ontology (OLC Figure 3.8) are reported as contributions to the body of accounting knowledge.

Contributions related to the CFfFR ontology are the decision process filter (Figure 7.19), and the ontology analysis (Figure 7.21) as well as the various findings made during the ontology development process. The research strategy followed and research techniques utilised also contribute towards the body of accounting knowledge as alternative ways to conduct accounting research. The contributions of this study are summarised in Table 9.2 and discussed in Chapter 9.

1.9 Publications from this study

The following publications have already resulted from this study:

Gerber, M. C., and A. J. Gerber. 2011. Towards the development of consistent and unambiguous financial accounting standards using ontology technologies. In *Proceedings of the International Conference on Accounting 2011*. Venice: IAAER.

Gerber, M. C., A. J. Gerber, and A. J. Van der Merwe. 2014. An Analysis of Fundamental Concepts in the Conceptual Framework Using ontology Technologies. *South African Journal of Economic & Management Sciences* 17 (4): 396–411.

Gerber, M. C., A. J. Gerber, and A. J. Van der Merwe. 2015. The Conceptual Framework for Financial Reporting as a Domain ontology. In *Americas Conference on Information Systems - AMCIS 2015 (accepted for publication)*. Puerto Rico: AMCIS.

Gerber, M. C., A. J. Gerber, A. J. Van der Merwe, and N. Stegmann. 2015. Formalising the Definitions of the Elements of the Statement of Financial Position. In *SAAA & IAAER Conference - 2015 (Accepted for publication)*. East London, South Africa: SAAA.

1.10 The Structure of the Research Project

The research report is structured in four sections and consists of ten chapters. The four sections are encircled with an introduction to the study (Chapter 1) and a conclusion (Chapter 10), summarising and reflecting on the knowledge gained in the study.

In Section A consisting of Chapter 2, the literature review is structured around the historical development of the CFfFR. The historical development of the CFfFR is presented according to a stimulus/response system (Salvary, 1979) illustrating an evolutionary development process starting in the pre-capitalist period (4000 B.C to 1000 A.D) and concludes with the current need for a global CFfFR.

Section B consists of Chapter 3 and contains the design of the research project. The research project was designed to answer the research questions formulated to address the research problem identified during the literature review (Section A, Chapter 2). In order to address the research problem a qualitative, multi-disciplinary study was performed. The research design is based on the research onion as explained by Saunders et al. (2012).

The implementation of the research design is reported on in Section C. The four chapters in Section C report on the execution of four design cycles performed according to the Design Science Research (DSR) strategy (Figure 3.2) (Vaishnavi & Kuechler, 2013). In Chapter 4 the requirements of a global CFfFR was determined. The role of a global CFfFR as a model is explained in Chapter 5. The knowledge obtained in Chapters 4 and 5 feeds into Chapter 6 and Chapter 7. In Chapter 6, the applicability of ontologies for financial reporting was determined. Based on the results



of Chapter 6, the artefact, a formal domain ontology for the CFfFR, was developed and reported on in Chapter 7.

Section D reports on the findings, evaluation and contribution of the study. Chapter 8 provides the findings made and an evaluation of the CFfFR ontology. In Chapter 9, the contribution to the body of knowledge gained during the study is presented. Finally, the study concludes with Chapter 10.

A schematic presentation of the research structure is provided in Figure 1.3.

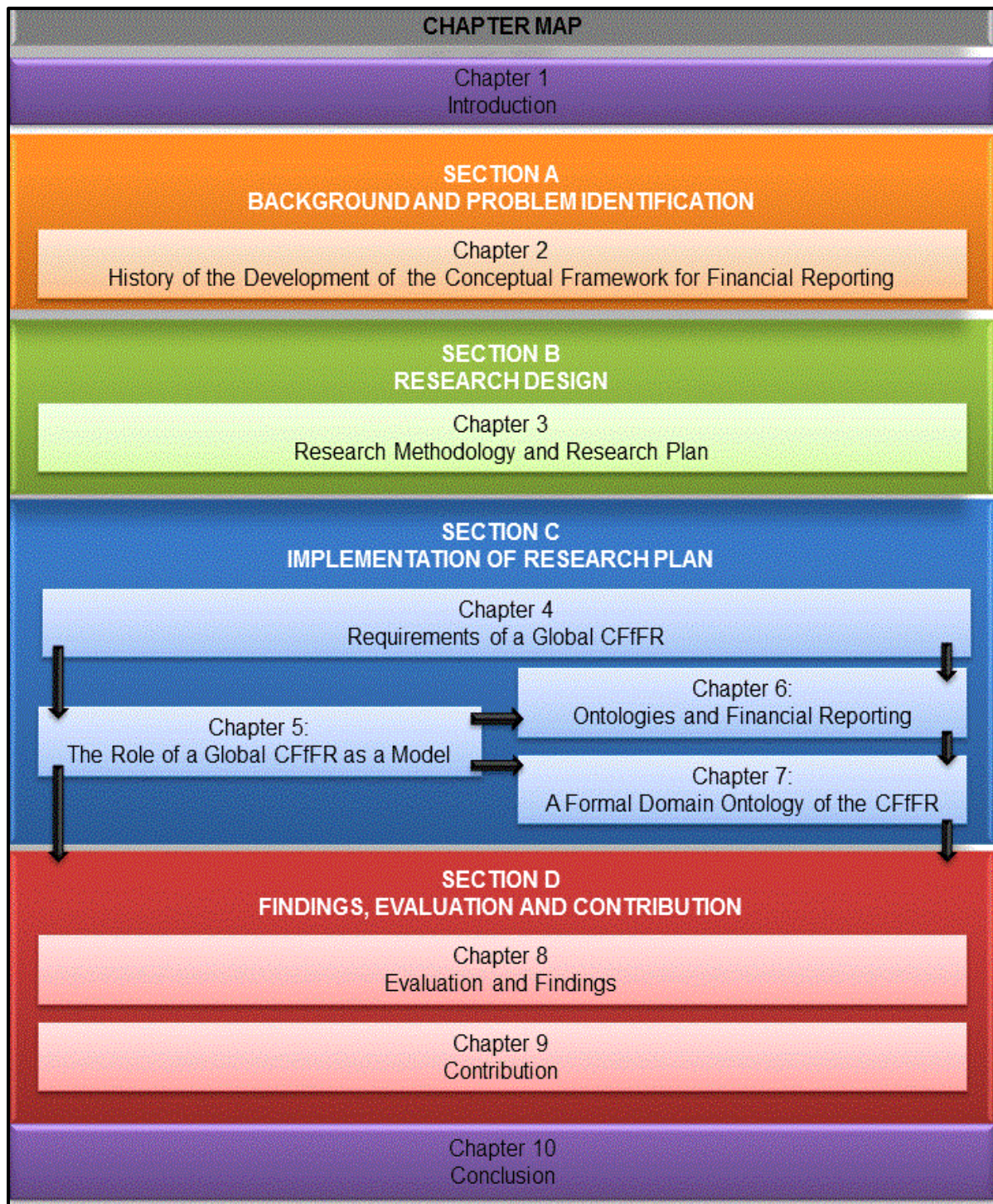


Figure 1.3: Chapter map

SECTION A – BACKGROUND AND PROBLEM IDENTIFICATION

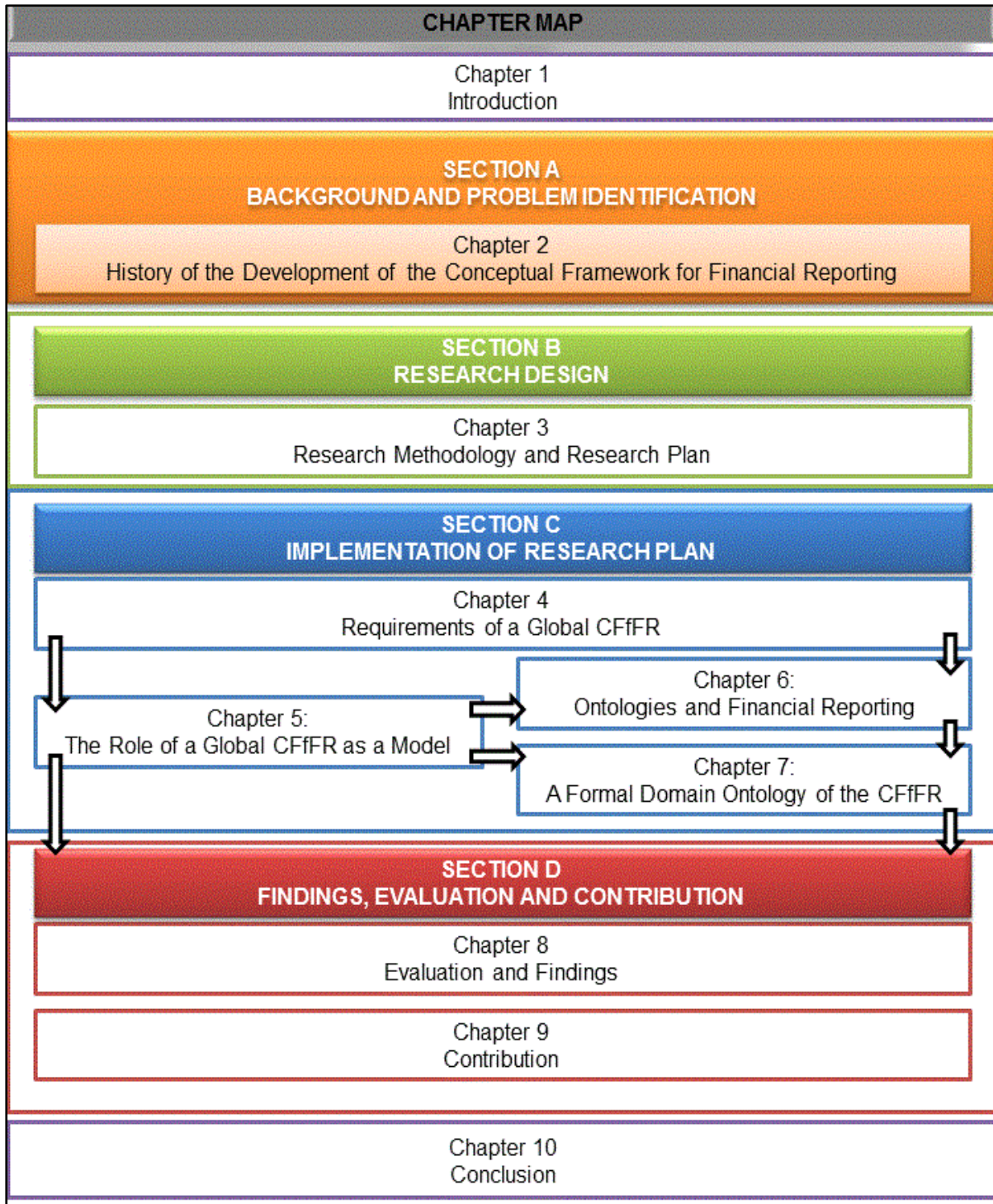


Figure 1.4: Chapter map - Chapter 2

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2 HISTORY OF THE DEVELOPMENT OF THE CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING (CFfFR)

2.1 Introduction

The importance of economic progress for the development of accounting is emphasised by Edwards and Walker (2009:1) when they state that “accounting has been implicated in key transitional events such as the emergence of capitalism and the Industrial Revolution.”² As the CFfFR can be viewed as the culmination of accounting principles and practices into one document, the development of the CFfFR is the result of external influences on and changing conditions of the world economy (Salvary, 1979). The purpose of the discussion on the historical development of The Conceptual Framework for Financial Reporting published by the IASB in 2010 (the CFfFR) (IASB, 2010a) is to indicate how and why the CFfFR developed over the ages.

According to Salvary (1979:2): “The accounting conceptual framework is characterized by a stimulus/response network in which a stimulus evokes a response.” Edwards (1989:14) is of the opinion that: accounting “...is adaptive in the sense that it is able to change, and it is persistent because it does not change without cause.” According to Gaffikin (2008:29) “accounting is very much a social construction. It has responded to a demand created by dominant economic and social forces”.

Chapter 2 broadly follows the four stages in accounting development as presented by Edwards (1989): the pre-capitalist period, 4000 B.C.-1000 A.D. (section 2.2); commercial capitalism, 1000-1760 (section 2.3); industrial capitalism, 1760-1830 (section 2.4); and financial capitalism, 1830 to date (section 2.5, 2.6, 2.7, and 2.8). Subsections within the broad stages are based on the discussion of the development of accounting principles, according to the stimulus/response pattern of Salvary (1979). The discussion according to Salvary’s (1979) stimulus/response network starts at 4 000 B.C. and concludes with the CFfFR as published by the IASB (2010a).

2.2 Pre-capitalist Period, 4000 B.C. to 1000 A.D.

The main feature of the pre-capitalist period is that wealth accrued to political, religious and military powers and is therefore called the non-economic period (Edwards, 1989).

2.2.1 Public Economy, 4000 B.C. to 700 B.C.

a) *Sumerian temples and the development of writing*

Although the earliest precursor of writing depicted as pictographs in caves dates back to the Upper Palaeolithic period (3500 – 1500 B.C.) (Senner, 1989), the earliest

² The link between economic progress and accounting change is discussed in Edwards (1989:8–19).

evidence of commercial financial record-keeping can be dated back to the early Mesopotamian period when the Sumerian, Babylonian and Assyrian Empires flourished (Keister, 1970). According to Senner (1989) the development of writing had a greater impact on the human race than the discovery of fire or the wheel. Writing can be seen as the foundation for the development of man's consciousness, intellect, comprehension of himself and the world around him (Senner, 1989).

Writing as a system of complex tokens, was developed and practiced in ancient Sumerian temple communities between 3350 and 3100 B.C. to manage, amongst others, the organising of production, concentration, management and redistribution of a surplus produced by the community (Salvary, 1979; Schmandt-Besserat, 1989).

State formation originated in the Sumerian temples and the first occurrence of complex tokens was documented in Uruk³ (Schmandt-Besserat, 1989). The rate of change in societal complexity accelerated and the first state-level societies appeared in the Late Chalcolithic period (4000 to 3100 B.C.) (also termed as Hammam V) in Uruk (Rothman, 2004). The development of state-level societies is directly linked to technological inventions.

The invention of the cuneiform script was closely linked to social, economic and technological development in the Sumerian period (Green, 1989). The cuneiform script was used for recording contracts, receipts and expenditures. A sign list and word list served to familiarise temple scribes with the words they needed for daily record-keeping (Biggs, 2009). The use of writing for record-keeping and the invention of the counting device coincide with the transition from hunting and gathering to the cultivation of grain in fields around the village and the construction of rectangular silos in a village economy (Green, 1989; Schmandt-Besserat, 1989).

The records (about 4000-year-old tablets) found in Mesopotamian ruins consist of tablets of receipts, disbursements, partnership formations and dissolutions, inventories, leases, purchases, sales, rentals, loans etc. (Keister, 1970) These records from Mesopotamia constitute the first developments of commercial record-keeping (Keister, 1970). Transactions were recorded in specific columns on a clay tablet in pictorial representations. The columns were summarized to provide totals and subtotals to present account balances (Kee, 1993). Some authors even referred to this system as the "Sumerian form of double-entry bookkeeping" (Kee, 1993:190). Although the system cannot be seen as double-entry bookkeeping, the Sumerian tablets had the function of "explicit and easily understood accounting" (Kee, 1993:190).

The changing economy resulted in a substantial increase in the population and a more advanced new social structure (Schmandt-Besserat, 1989). With the increase in population the economy progressed to planning for subsistence over seasons and that required record-keeping over time (Schmandt-Besserat, 1989). The response to the development of a complex token system of record keeping was the formation of

³ The city of Uruk was founded around 5000 B.C. and the Stone-Cone Temple was built between 3800 – 3400 B.C.

urban civilisations with better control over resources produced by the new agricultural driven economy. The technology developed in the Sumerian temples to exercise control over resources improved into proper writing records, which served as the stimulus to the rise of the Sumerian, Babylonian and Assyrian Empires.

Since the Sumerian period (3500 B.C. to about 1940 B.C.), social, economic and technological development have been linked. The development of state-level societies can thus be seen as a direct link, or response to the written control of agricultural resources.

It can be concluded that the change in the economy from hunting and gathering to the cultivation of grain and the urban phenomenon was the stimulus to develop a complex token system of record-keeping, which in the end resulted in the development of state-level societies. The need for control over resources in a primarily state owned economy in the Sumerian, Babylonian and Assyrian Empires was also the primary stimulus to develop written records of resources (Salvay, 1979). According to Green (1986) the Chaldean-Babylonian Empire was a highly developed government as early as 4 500 B.C.

An example of Cuneiform symbols:

<h1>Cuneiform</h1>						
	3000 B.C. I	2800 B.C. II	2500 B.C. III	1800 B.C. IV	600 B.C. V	
1						an
2						ki
3						lu
4						sal
5						kur
6						geme
7						sag
8						ka
9						ninda

Figure 2.1: Cuneiform symbols

Source: Western Washington University – Pandora Web Space

<http://pandora.cii.wvu.edu/vajda/ling201/writingsystems/sumeriancuneiform.htm>

An example of the Sumerian syllabic glyphs used by the scribes:

ā	á	e	é	i	í	u	ú
ba	bá	bà	be	bé	bè	bi	bí
bu	bú	bù	da	dá	de	dè	dí
di	dí	du	dú	dù	du4	ga	gá
ge	gé	gè	gi	gí	gì	gi4	gi5
gu	gú	gù	gu4	gu5	gu6	gu7	ha
há	hà	ha4	he	hé	hi	hí	hu
ka	ká	kà	ke	ké	ki	kí	ku
kú	kù	ku4	la	lá	là	le	lé
li	lí	lu	lú	ma	má	me	mé
mè	mi	mí	mi	mu	mú	na	nu
ná	nà	na4	ne	né	ni	ní	nú
nú	pa	pá	pe	pé	pi	pí	pì
pu	pú	pù	ra	rá	re	ré	ri
rí	ru	rú	rù	sa	sá	sà	sa4
se	sé	si	sí	su	sú	sù	su4
ša	šá	šà	še	šé	ši	ší	šu
šú	šù	šu4	ta	tá	te	ti	tì
ti4	tu	tú	tù	za	zá	ze	zé
zi	zí	zì	zu	zú			

Figure 2.2: Sumerian syllabic glyphs

Source: Ager (2013) *Omniglot: The online encyclopaedia of writing systems & languages*.

b) Development during the Minoan period and Greek Dynasty

During the Minoan period another civilisation started in the south of Europe when palaces were built in Crete between 1900 - 1400 B.C. Tablets were used in the palaces to keep record of transactions, people, animals, commodities, food,

implements, and weapons. The purpose of these records was to “record the incomings into the palace of these items and the sending out or distribution of goods into the surrounding countryside” (Stroud, 1989:109).

The Greek Dynasty that started in Crete expanded during the Mycenaean age (1600 – 1100 B.C., the last phase of the Bronze Age in Ancient Greece) and continued until the end of the seventh century. With the expansion of the Greek Dynasty, the Greeks spread over the Mediterranean from the eleventh century B.C. to the end of the seventh century B.C. During this time, a number of colonies were founded in the Eastern and Central Mediterranean. The expansion of the Greek Dynasty had a great economic, political, social and cultural impact on Greece and the Mediterranean (Stroud, 1989).

According to ancient authors like Thucydides and Plato, the lack of land was the cause of Greek migration to other regions.⁴ A policy prohibiting the dividing up of a father’s estate among legatees (Toutain, 1930) caused the lack of land. This policy is described in ancient writings like the *Iliad*, *Odyssey*, and *Works and Days*. The initial stimulus for Greek migrations settled in a government policy prohibiting the division of land.

Link between Mesopotamian, Egyptian and Greek record keeping

The Greeks implemented record-keeping practices to keep track of their resources during the colonisation process in the Mediterranean. In these record-keeping practices, the link between Greece and Mesopotamia can be found. The commercial record-keeping practices developed in Mesopotamia spread to the successive empires of Egypt and Ancient Greece. Keister (1970) demonstrates the connections and similarities between Mesopotamian, Egyptian and Ancient Greek records. The Mesopotamian influence in the accounting practices on both the Egyptian and Greek administrations is evident from the Zenon Papyri (Hain, 1966). The similarity between the Mesopotamian and Greek systems is so strong that it is suggested that the Greek administration was a direct descendant of the Mesopotamian system (Keister, 1970).

Initially Greece used the same record-keeping pattern as the Babylonian Empire to manage resources. “The money wealth was lodged in the temples but under the control of the state. The Parthenon was the treasury of sacred valuables” (Green, 1986:38). Record keepers (clerks) annually reported to the state on the property in the temples by means of financial statements indicating income from rentals, interest on loans and expenditures used for sacrifices, wages and entertainments (Green, 1986).

⁴ The economic causes and consequences of the Greek migrations and their importance is discussed in detail in Toutain (1930).

Purpose: control over resources

The Greek administration was mainly concerned with securing imports of materials and commodities essential for life in the city and to manage the collection of taxes (Austin & Vidal-Naquet, 1980). With the expansion of the Grecian Empire during the Greek Dynasty, the need for centralised government caused the scope of writing to expand. Written records served to help the administration to manage resources across distances and over long periods of time (Salvary, 1979).

By 700 B.C., the objective of command over resources by means of written records was well established across the Grecian Empire. The administration was in the hands of the assembly with numerous boards and officials reporting to the assembly regarding the funds to the government. Clerks kept record of the public funds and were in turn controlled by checking clerks. The most important financial officer was the Treasurer or Manager of Public Revenue (Edwards, 1960).

The main stimulus during the period 4 000 B.C. to 700 B.C. was the need for control over resources. The need to control resources during the Greek Dynasty was caused by a government policy not to divide land resulting in the colonisation of neighbouring countries. This policy served as a stimulus to search for control mechanisms of state resources. The response was the development of written documents managing state resources. The response created a stable state ownership economy, which then paved the way for the development of new empires and a new type of economy, *i.e.* the feudal system.

2.2.2 Feudal System, 700 B.C. to 1000 A.D.

As the Greeks moved out of Greece to settle in the colonies and started working the land with their agricultural technologies, the value of the land increased. The Greek settlements also started trading with the neighbouring states and tribes (Toutain, 1930). During this process, the Greeks mastered the sea-routes and for example started importing metals from Caucasus and Armenia, and food, raw materials and manufactured goods from Cyprus, Syria and Egypt (Toutain, 1930).

a) *Money: moveable wealth*

During the expansion period, the Greeks discovered a new form of wealth; money. This movable form of wealth “then took its place by the side of landed wealth in the economy of the Greek world” (Toutain, 1930:31). The earliest examples of coins date from the seventh century B.C. Coins were made of precious metal; gold, silver or electrum (Toutain, 1930). The use of money made it possible to trade across borders and to accumulate wealth not linked to land. Money became an instrument to finance economic activities by lending it out to manufacturers and merchants. Money lent out at interest was known by the Athenians as active capital or working capital (Toutain, 1930).

b) Birth of the banking-system and commercial legislation

The new economic system of trading with and the lending out of money gave birth to a new profession, the banking-system. The bankers or money-changers (*trapezitai*) provided a variety of financial and commercial services to their clients as described in Toutain (1930:75–76). With the expansion of business, commercial legislation was introduced by the state to ensure honest dealings and transactions and with that, commercial law came into being. The impact of the use of money on the economy is summarised by Toutain (1930:79) as follows: “The economic development had a decisive influence on the character of property, the organisation of labour, and the nature of commercial operations. Movable wealth assumed an important position by the side of landed wealth. Then what is known as capitalism made its appearance.” The expansion of the Greek Empire and availability of capital stimulated some private initiatives and according to Green (1986:39) “companies and partnerships existed in Greece as early as 400 B.C.”.

c) Accounting records and corporate governance

Due to the expansion of the Greek Empire, the administration had to develop to keep track of state resources and taxes. The state also included some corporate governance in their administration as the accounts of the financial administration were published by engraving it on stone and placing it outside the temples for public inspection (Green, 1986). The operations of the state banks were managed in the larger temples. In order to manage the finances of the state, the Council created the position of a treasurer around 300 B.C. Accounting records consisted of contracts, letters of credit, daybooks and ledgers. During the Hellenistic Age under Alexander the Great (323 – 31 B.C.) the Greek culture and civilization spread throughout the world. The well-established Greek administration and culture were transferred to the countries concurred under the Hellenistic Age. During the Pax Romana (31 B.C. – 180 A.D.), a period of peace between Greece and Rome, the Romans welcomed the Greek culture and the two empires influenced each other.

d) Sophistication under the Roman Empire

According to Green (1986:39), “accounting under the Roman Republic reached a high degree of perfection.” The accounting method involved daily entries of receipts and disbursements in a daybook. Transactions were recorded in the *tabulæ publicæ*. On a monthly basis, the transactions were posted to a ledger resembling the *codex accepti et depensi*. A register of debts or *calendarium* was kept (Brown, 1905). Julius Caesar made some improvements and introduced personal supervision over financial matters. During the reign of Augustus, the Roman Emperor used the imperial financial information to help with planning and budgeting (Oldroyd, 1995). The financial system improved over the years until Diocletian had, at the end of the third century, divided the Roman Empire into twelve dioceses

e) *Greek and Roman influence on legislation*

The main purpose of the accounting practices during the Greek and Roman Empires was to manage state resources and ensure that all taxes were collected. The link between legislation and accounting practices can be traced back to the following two examples of legislation to manage state resources. Charlemagne issued his *capitulore de Villis* in 812 A.D. This ordinance contained instructions for the administration of imperial estates. According to the ordinance, every steward on the Emperor's estates had to provide annual reports containing an inventory of land and of income and expenditures (Edwards, 1960).

The same happened in England when William I invaded England in 1066. He took control over all property in England and ordered a survey of the crown lands. The survey was documented and compiled into what is known as the Domesday Book⁵ (Green, 1986). The English Pipe Roll of 1130-1131 is the best-preserved accounting record indicating royal control over revenue and property. The Pipe Roll is based on the Domesday Book. In England and Scotland, the Exchequer was established during the reign of Henry II. The upper Exchequer had control over collection and disbursement of royal revenues and the lower Exchequer managed the receipt and issue of public money (Green, 1986). The accounting system used by the manor and exchequers is called charge and discharge accounting (Edwards, 1989).⁶

f) *Move towards a feudal system*

During the period 700 B.C. to 1204 A.D. the state ownership economy, as indicated above, moved to a feudal system⁷ (Salvary, 1979). The change in the political system to the feudal system during the Byzantine Empire was the stimulus to loosen the ownership of property out of the hands of the state. Whittow (2010) argues that the economic growth in some parts of Europe started as early as the seventh or eighth century and that the stimulus for the growth lay in peasant enterprise. The tenth-century land legislation is evidence of landed aristocracy and the existence of free peasantry (Whittow, 2010). The free peasant farmers of the tenth century were already responsible for a substantial proportion of the empire's output. The response was a feudal economy with more land in the hands of feudal landlords and free peasant farmers working the land. According to Strayer (1956:16) "all authorities would admit that feudalism reached its height in the eleventh and twelfth centuries."

Life in Europe changed after 1000 which "provided the stimulus for major developments in bookkeeping" (Edwards, 1960:451). The manor and village gave way to the town, manufacturers and craft specialization increased, trade grew and broadened and the guild system took root and flourished. At the end of the period, some of the feudal lords were forced to let go of some of their land. Land in private

⁵ Domesday Book is a manuscript record of the great survey, completed in 1086 on orders of William the Conqueror, of much of England and parts of Wales.

⁶ J.R. Edwards (1989:32-44) discusses charge and discharge accounting in detail.

⁷ In a feudal system the king or state provide land to a landlord to manage on behalf of the king or state. The landlord then provides land to free peasants to work the land and earn income.

hands marked the very first steps of an exchange economy (Salvay, 1979). An exchange economy involves the exchange of monetary units for resources (Brunner & Meltzer, 1971).

2.3 Commercial Capitalism, 1000 to 1760

With private property ownership emerging it became possible for individuals to enter the commercial market, first in an exchange economy (1000 to 1500) and later (1500 to 1760) as entrepreneur in a more private capital-intensive economy.

A number of developments encouraged the transition to an entrepreneurial economy from the fourteenth century onwards. On the technological front, the printing press was invented and the use of Arabic numerals became commonly accepted. On the economic front, private property ownership became more common and individuals started to invest capital in ventures and partnerships. The entrepreneur started to manage a business exceeding his personal financial capacity.

The following developments, amongst others, provided the stimulus for more accurate accounting and better financial reporting:

- the art of writing,
- money as monetary unit,
- cross regional commerce,
- provision of credit,
- private ownership,
- the invention of printing,
- the use of Arabic numerals,
- capital invested in ventures,
- joint ventures and partnerships, and
- the need to compute profits.

2.3.1 Exchange Economy, 1000 to 1500

The period between 1000 to 1500 was dominated by an exchange economy where interregional trade flourished (Salvay, 1979). The stimulus during this period was a lack of organised capital markets, the desire to make investments as well as the inadequacy of the charge and discharge accounting system to meet growing business requirements (Edwards, 1989). The Mediterranean commerce during the eleventh to the thirteenth centuries signalled the advent of commercial capitalism (Edwards, 1989).

a) *Medieval trading: Genoa and Venice*

Business developed during the late-Medieval (Lopez & Raymond, 2001) and early Renaissance in the great Italian trading centres in the northern part of Italy when Genoa and Venice were established as the main commerce centres between Europe and the Near East (Edwards, 1989; Edwards, 1960).

The following illustration provides an overview of the trading routes used during the late-Medieval times (Wukitsch, 2014)⁸

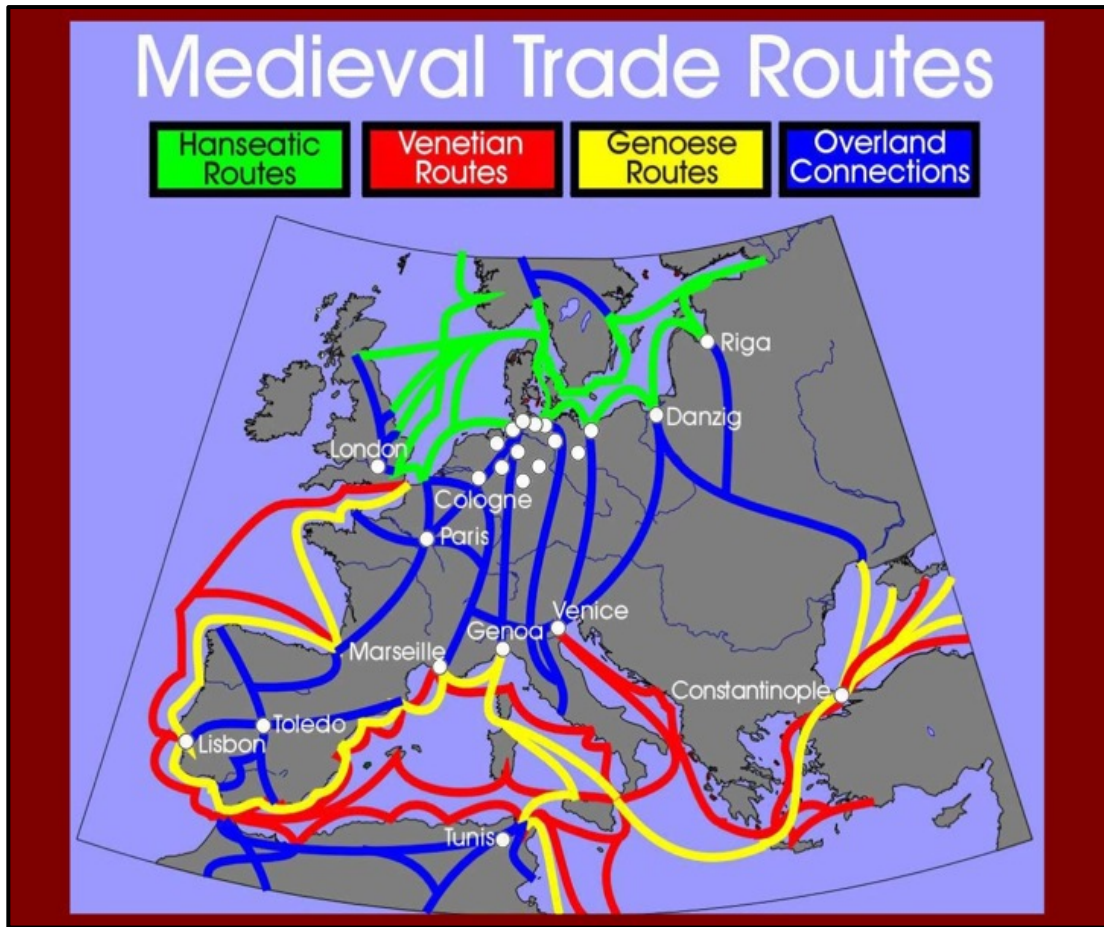


Figure 2.3: Medieval Trade Routes

The increase in business with other regions stimulated the shipping industry. Venice controlled the Mediterranean trade and became the leader in banking and record keeping (Edwards, 1960).

b) Partnerships as business vehicle

The exchange economy depended upon the interaction between investors and business operators. Those with wealth continually moved from opportunity to opportunity (Salvary, 1979). The partnership contract was developed in Italy to facilitate the business agreements. The capital of the partners was stated separately and the partnership contracts stipulated how profits and loss were to be shared and also made provision for the dissolution of the partnership (Edwards, 1960).

⁸ For a comprehensive discussion on Medieval Trade in the Mediterranean World see Lopez and Raymond (2001).

c) **Method of Venice – double-entry bookkeeping**

During the thirteenth and fourteenth centuries, the enormous growth in Florentine commerce served as a stimulus for the development of bookkeeping as capital owners had to keep track of their investments. Another stimulus to bookkeeping was the discovery of the sea routes to India (Edwards, 1960; Littleton, 1966). The growing importance of the Atlantic shipping routes and access to the East around the Cape of Good Hope and the Americas served as a stimulus for financial innovation in Europe to move to the north. Bruges emerged as the centre of trade between the Mediterranean and the Baltic (Michie, 2008).

Because of the movement between opportunities, planning for investment by owners of capital and the execution of the opportunities by business operators became a major objective. “Partners in a business, ..., required a record of the entire course of trading so as to apportion profits, and it is in this necessity that we find the prime motive for creating a system of book-keeping” (Fogo, 1905:97). A complete system of double entry bookkeeping is found in the accounts of the stewards in Genoa in 1340 (Edwards, 1960; Fogo, 1905; Green, 1986). The firm Donado Soranzo and Brothers used the double-entry system in their ledgers. One of the ledgers of this firm, which covers the period 1406-1434, is complete with a Profit and Loss Account and a Capital Account (Fogo, 1905; Green, 1986).

A document prepared by Benedetto Cotrugili entitled *Della Mercatura e del Mircanti Perfectto Della Mercautra* that was most probably completed in 1458 (Edwards, 1960; Green, 1986) or 1463 (Fogo, 1905), is believed to be the foundation for the influential publication of Luca Pacioli⁹ entitled *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita*¹⁰ published in 1494 (Edwards, 1960; Fogo, 1905; Green, 1986). The Franciscan Monk Fra Luca Bartolomeo de Pacioli was the first academic to publish on accounting¹¹ and is seen as the father of modern accounting (Littleton, 1966).

Pacioli used the method of Venice already in use to systematise and formulate the principles for the double entry bookkeeping system. The procedures prescribed by Pacioli did not originate with him, he only formulated one of the bookkeeping practices already in use in Italy (Fogo, 1905; Peragallo, 1956). This is made clear by Pacioli when he stated that: “We shall use the method of Venice, which is certainly to be commended above the others, and the understanding of all others” (from the title page of the *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* as translated by Green (1986:94)).

⁹ Littleton (1966:76) has a note on the spelling of Pacioli’s name. Some authors spell it Pacioli and others spell it Paciolo. In this study, Pacioli will be used.

¹⁰ Fogo (1905:109–120) and Green (1986:95–105) provide a detailed discussion of the practises and procedures of the method of Venice as explained by Pacioli in the “*Summa de Arithmetica, Geometrica, Proportioni et Proportionalita*”.

¹¹ Littleton (1966:23) provides a list of publications on bookkeeping until 1796 following the publication by Pacioli.

The main purpose of the *Summa Arithmetica, Geometrica, Proportioni et Proportionalita* was to serve as a reference text to the merchants and as an aid for the education of their sons. (Sangster, Stoner, & McCarthy, 2008). The *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* served as a bookkeeping framework and guide for bookkeepers in Italy, Europe and England through the teachings and publications of Dominico Mangoni 1534, Jan Ympyn Christoffels 1543 and 1547 and Hugh Oldcastle 1543 (Edwards, 1960; Fogo, 1905). By the end of the fifteenth century a fully developed bookkeeping system known as the “Method of Venice” (Edwards, 1960; Fogo, 1905) was the response to the stimulus and was functioning in the commercial centres of Italy.

d) Useful financial information

The expansion of commerce in Italy and Europe and the development of partnerships created the need for business information. As already discussed, the response was the basic principles of double entry bookkeeping as formulated by Pacioli. Green (1986:91) confirms this by stating: “Pacioli’s treatise on bookkeeping which was published in 1494 was the answer to an insistent economic demand for a standardised system of recording business transactions.”

The bookkeeping system or framework and planning document provided information to traders regarding their assets and liabilities (Edwards, 1960) to assist them with making business decisions. According to Fogo (1905:111) “the object of book-keeping is stated by Paciolo in precise terms: to give the trader without delay information as to his assets and liabilities”. It seems as if the objective of usefulness of general purpose financial reporting, as it is formulated in the CFFR “to provide financial information about the reporting entity that is useful to existing and potential investors, ...” (IASB, 2010a:par. OB2) was in essence part of the motivation for Pacioli to publish the *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita*. Pacioli indicated the objective of usefulness and necessity of financial information to the merchant as follows:

“The third and last thing necessary is that he should arrange all his dealings in good order, in order that he may quickly find the complete record of each, both as to debit and credit, for business takes no notice of anything else. And this part is among others most useful to them, for it would be impossible to conduct their business otherwise” (from the title page of the *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* as translated by Green (1986:93,94)).

Ijiri (1995:284) summarises the contribution of Pacioli as follows: “Fra Pacioli of Sansepolcro deserves the highest praise that can be given to an intellectual product – ‘Double-entry bookkeeping is a thing of beauty, indeed!’”

e) Acceptance of the Arabic numeric system

During this period, the use of the Arabic numeric system as part of the double entry bookkeeping system contributed to the acceptance of the double-entry system. According to Edwards (1989:46), “it was not impossible to use Roman numeral as the

basis for double entry but, in a society where only these existed, they prevented the necessary conceptual breakthrough from being made.” The widespread use of the Arabic numeral system only became common during the seventeenth century. The Roman system was abandoned in Britain between 1668 and 1699 (Edwards, 1989). The adoption of the new “technology” of Arabic numerals contributed to the acceptance of the double entry bookkeeping system as it assisted with arithmetic calculations or pen-reckoning when the numbers were neatly arranged in columns (Edwards, 1989).

It can be concluded that the discussion of the period 1204 to 1500 indicates that the response to the need for a developing exchange economy for useful financial information resulted in the development of the double entry bookkeeping system that still forms the basis of current bookkeeping practices. We also find that, usefulness as the objective to provide financial information, formed part of Pacioli’s motivation to publish the *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita*. The publication by Pacioli served as a framework on bookkeeping for other authors in Italy in Europe. Lastly, the use of the Arabic numeral system as a “new technology” assisted with the adoption of the double entry bookkeeping system.

2.3.2 Entrepreneur and Continuity of Business, 1500 to 1760

During the period 1500 to 1760, the entrepreneur emerged (Salvary, 1979). The entrepreneur managed a business with resources exceeding his personal capacity independent of himself. The economic development in Europe during the seventeenth century is marked as the last phase of transition from a feudal to a capitalist economy and is seen as the period of transition to capitalism (Wallerstein, 1980) with active securities markets established in Europe and America by the end of the seventeenth century. According to Salvary (1979) the stimulus during the period was the need for long term financing. The response was the concept of capital.

a) *The accounting equation – Hugh Oldcastle 1543*

The accounting concept of capital prepared the business world for the securities market in the trading of capital (Salvary, 1979). The influence of Hugh Oldcastle (1543) during this time is important to the development of financial reporting. Oldcastle, a teacher of arithmetic and bookkeeping in London produced an English translation of Pacioli’s *Summa* (Brown, 1905; Edwards, 1960).

The concept of continuity as portrayed in the balance sheet is based on the capital model formulated by Hugh Oldcastle in 1543 in England,¹² namely $\text{Capital} = \text{Assets} - \text{Liabilities}$. The balance sheet was regarded as the most important financial statement and was used to answer stewardship questions. Emphasis was placed on assets, liabilities and equity whilst revenues and expenses were not regarded as important especially in the agricultural environment (Edwards, 1996). Oldcastle’s

¹² According to Salvary (1979) the statement “balance sheet” is attributed to Hugh Oldcastle as cited in the work of John Mellis (1588).

contribution is that he was more clear than Pacioli on how to deal with the profit and loss and the capital accounts (Edwards, 1989) and provided a description of a trial balance (Peragallo, 1956). The continuous effect of capital was carried in the trial balance as clearly formulated by Ympyn.

b) *The trial balance – Ympyn 1543*

In 1543, Ympyn published his *Nieuwe Instructie* in Antwerp in which he describes the trial balance. “Ympyn, is the first author to use the balance account properly as an account in the ledger” (Peragallo, 1956:393). Ympyn firstly transfers the balances of the various merchandise accounts to a “remaining goods” account. He then transfers all the nominal accounts to the profit-and-loss account, the latter being closed into the capital account. From this description, it seems that the use of a capital account was already established in 1543. The concept of capital, carried forward from one year to another, prepared the business world for the securities market.

c) *The origin of the securities market*

The securities market was formally recognised in 1773 when the brokers who erected their own building in Sweeting’s Alley officially formed the London exchange. The origins of the capital market can however be traced to Venice during 1171-2 when the Venetian government promised to pay interest on compulsory loans from its wealthy citizens. These interest-bearing bonds provided by the Venetian government were sold by the holders in need of money and bought by others who wanted income from their savings (Michie, 2008). The transactions and transfers of bonds between individuals were, at that stage, private transactions and not regulated by the government of Venice. As new shipbuilding technologies developed, other shipping routes were discovered and the initiative moved away from Venice.

The importance of the Atlantic shipping routes to the East and the Americas resulted in the financial incentive moving from Italy to the north of Europe. Trading of primarily money and bills between the Italian merchants and entrepreneurs and bankers took place on the Bruges Bourse in the Place de La Bourse. The Bruges Bourse was named after the Beurse family who had an inn, the Place de La Bourse in Bruges (Michie, 2008). According to Michie (2008) the term Bourse became synonymous with that of Stock Exchange.

As trading across the Atlantic expanded the need for finances also increased. In the early sixteenth century Bruges, Antwerp, Lyon and Genoa were viewed as the cities giving financial leadership in Europe. The securities market developed with Bourses built all over Europe in Cologne (1553), Paris (1563), London (1571), Seville (1583) and Frankfurt (1585). Antwerp defaulted on its borrowings in 1570 and was replaced by Amsterdam to become the commercial centre of Europe (Michie, 2008).

d) *De Wisselbank van Amsterdam*

The founding of the Bank of Amsterdam (*De Wisselbank van Amsterdam*) in 1609 marked the beginning of bank transfers of money between merchants through debits

and credits (Wallerstein, 1980; Michie, 2008). The role of Amsterdam as financial leader in Europe and the ability to transfer money between merchants was important to the economic development of the Dutch and Europe.

With the religious wars in France, Germany and Britain between 1550–1649, the defeat of the Spanish Armada by the English in 1588, the Thirty Years' War from 1618–1648 and the English civil war between 1642–1648 (Stearns, 2005) merchants could no longer depend on governments to grant security for loans and bonds. There were no securities that served the need for short-term money (Michie, 2008). In order to keep on trading over the Atlantic the Verenigde Oostindische Compagnie (VOC) or Dutch East India Company was established in 1602. The VOC issued a large number of shares and very soon an active securities market emerged. It is estimated that by 1620 there were 65 000 investors in the Netherlands. The need to raise capital from the general public in the active securities market in the early seventeenth century and the separation of ownership from management resulted in published financial statements for use by the shareholders. The officers of the VOC had to annually provide a balance sheet ("*Ballance of all the said accompts*") to the company by the last day of June (Edwards, 1996).

Towards the end of the seventeenth century (around 1688) the securities market in Amsterdam was quite sophisticated with financial techniques such as spot and future contracts; call, put, and straddle options; margin trading, hedging, short-selling and the ability to defer both payment and delivery (Michie, 2008). The contribution of Amsterdam was "the design of trading methods which permitted investors to buy and sell securities in such a way as allowed them to employ short-term funds remuneratively, without exposing themselves to undue risk of either absolute loss or inability to realize their investment when required" (Michie, 2008:28). The active securities market stimulated the need to provide financial information to investors and potential investors.

e) *The era of mercantilism – Shipbuilding and productive efficiency*

The period from 1600 to 1750 is known in history books as the era of *mercantilism* (Wallerstein, 1980). Two agreed upon industry concepts of mercantilism, are productive efficiency and shipbuilding (Wallerstein, 1980). The United Provinces (Holland) took the lead in the early stages of mercantilism in both of these industry concepts.¹³ The Dutch increased their productive efficiency and shipbuilding technology to become superior over other European countries to what is called the Dutch hegemony in the world economy. The Dutch had "*simultaneously* productive, commercial and financial superiority *over all other core powers*" (Wallerstein, 1980:39).

The stimulus for the era of mercantilism can partly be ascribed to the technological advances to produce more efficiently and the ability of the Dutch to build cleaner,

¹³ Wallerstein (1980:37–71) presents a detailed discussion on the Dutch hegemony in the world economy between 1625-1675.

cheaper and safer ships (Wallerstein, 1980). One of the reasons for the capitalist strength of Amsterdam in the seventeenth century was the sound public finances, combined with a worldwide commercial network (Wallerstein, 1980) which can be seen as a response to the economic expansion caused by the technological advances developed by the Dutch. The need for long term financing by the entrepreneur served as stimulus for the development of the concept of continuity of capital.

The strength of the world-economy slowly shifted from the United Provinces to England and France with England becoming stronger than France by the end of the seventeenth century (Wallerstein, 1980). Wallerstein (1980) attributes England's strength in the world-economy to political measures by the English state.¹⁴

On the European political front the period between 1651 and 1763 can be divided into two phases. The first period, 1651 to 1689, is the period of Dutch hegemony that ended with the accession of William and Mary to the throne of England. The second period, 1689 to 1763, depicts a period of unbroken Anglo-French rivalry. Although there was a lot of movement on the political front in Europe between 1600 and 1750, the "European world-economy went through a long relative stagnation of the total production of the system as a whole" (Wallerstein, 1980:245). After the stagnation, a stimulus in the form of technological advancement in the production system resulted in a reaction known as the Industrial Revolution.

2.4 Industrial Capitalism, 1760 to 1830

The period 1760 to 1830 is known as the period of the Industrial Revolution. Some factors contributing to the increase in industrial activities were lower food prices in Britain, better nutrition and health, and an increase in personal hygiene that caused an increase in life expectancy. Because of the better living and health conditions a growth in the population was experienced (Hendriksen & Van Breda, 1992). This in turn led to growth in industries.

2.4.1 Demand for Capital and Capital Maintenance

The growth in industries during the industrial revolution lead to an increase in the requirements for capital and the need to maintain capital in the canal, manufacturing, steel, railway and coal industries (Sylla, 2009; Edwards, 1996).¹⁵ During this time, a key to the success of the railway companies was to obtain a monopoly to be able to purchase land for the railway lines. The railway companies were capital intensive and had to raise capital from investors. The need for capital had major implications for the development of the capital markets (Edwards, 1996).

¹⁴ See Wallerstein (1980:114–125) for a detail discussion on the reasons why the English became stronger than the French.

¹⁵ The requirements for capital is clear from the discussion of Sylla (2009) regarding the UK and US financial systems.

The demand for capital is reflected in an increase in the number of banks during this time. According to Hendriksen and Van Breda (1992) there were 80 banks in London and 400 banks in the country by 1800. The London Stock Exchange was officially established in 1773. The New York Stock Exchange followed shortly afterwards in 1792. In the UK, the chartered company dates back to the sixteenth century and provided a vehicle to obtain capital and conduct trade overseas (Sylla, 2009).

2.4.2 Demand for Accountability and the Double-entry System

As investments grew, the call for accountability also increased. Shareholders started to demand investigations into the books of companies and public accountants were called in to provide financial expertise (Edwards, 1996).

Although the double-entry system was developed in the thirteenth century, the tendency was to still use the charge and discharge system of accounting to manage the finances of the growing companies at the beginning of this period (Edwards, 1989). Two major limitations of the charge and discharge system experienced with the new economic development was that firstly, it did not show the amount of capital invested by the owner and secondly, that it could not be easily adapted to provide profit and other performance information (Edwards, 1989). The need to raise capital from the general public and the separation of ownership and management created the need for published financial statements (Edwards, 1996). The double-entry accounting system suited this need. In addition, the double-entry system is also more comprehensive and orderly, as it provides a check on accuracy and completeness of the ledger and the records contain the information to prepare the required financial reports (Edwards, 1996).

2.4.3 Demand for Financial Reports

The call by investors and business owners for accountability by the managers of a business increased the demand for financial reports to absentee owners (Hendriksen & Van Breda, 1992). There is evidence of financial reporting of a high standard. Financial reporting of two firms of charcoal and iron makers for example included transfer prices, allocation of joint costs to determine profits and losses on departmental level and Welsh industrialists used fundamental accounting concepts like – going concern, accruals, consistency and prudence (Edwards, 1996). The stimulation for accounting development during the industrial revolution was the demand and opportunity for large amounts of capital to be invested. The accounting response was financial reporting to inform the investors of the status of their investments.

The level of sophistication that stock exchanges reached by the early nineteenth century, the ever-increasing demand for large amounts of capital and the relatively high standard of financial reporting combined with some sound accounting practices, created the opportunity for businesses to utilise the financial instruments at their disposal to provide more investment opportunities for ordinary people.

2.5 Financial Capitalism: Return on Capital Invested 1830 to 1900

The period of financial capitalism started with the demand for large amounts of capital to set up and expand large corporations. Capital was mainly raised by the issue and trading of shares on stock markets. The demand for financial information by managers, investors and other users of financial information therefore dominated accounting and financial reporting in the capital markets.

The economic climate was positive at the start of the Victorian era due to economic growth and the rise of capital markets to promote construction in the railway industry (McCartney & Arnold, 2010). As London was the biggest securities market, taking over from Amsterdam around 1820 (Michie, 2008) and continuing to be the financial centre of the global capital market until 1913 (Neal, 2009), most of the discussion in this section will be focused on the developments in the UK. During 1845-49, expenditure in the railway industry represented 4-5 per cent of the gross national product in the UK (McCartney & Arnold, 2010). In the United States the number of railroad stocks increased from three in 1835 to ten by 1840 (Michie, 2008).

2.5.1 Unregulated Financial Reporting

Financial reporting in the UK was unregulated in the nine tenth century with few statutory requirements (Arnold & McCartney, 2002). The London Stock Exchange (Michie, 2008) prescribed minimum regulations and reporting practices varied and changed considerably and quite quickly (McCartney & Arnold, 2010; Edwards, 1989). Accounting regulation in the UK assumed a *laissez-faire* system with minimal regulatory guidance (Gaffikin, 2008; Street, 1996). In the UK the Joint Stock Companies Act was only passed in 1855 (McCartney & Arnold, 2010).

a) *Capital expenditure and depreciation*

The nature of the railway industry, having more long term assets, challenged managers and accountants on the treatment and forecast of an assets life (McCartney & Arnold, 2003; Edwards, 1989). The treatment of long-term assets (capital expenditure) by calculating and accounting for depreciation¹⁶ on such assets was one of the most important accounting concepts to be standardised. The recommendation of the Monteagle Committee (1849) and the passing of the Railway Companies Act 1867 (Edwards, 1989) serve as evidence of the importance of regulating capital expenditure.

b) *Separation between management and ownership*

According to Littleton (1966:149) “by the end of the nineteenth century the development of separate financial statements was well under way.” The increase in separation between management and ownership, where shares were traded on a stock exchange, increased the importance of reliability and accuracy of financial

¹⁶ See Littleton (1966:223–241), Edwards (1989:113–116, 122–124) and (Arnold & McCartney, 2002) for a discussion on the development and treatment of depreciation in the nineteenth century.

reports. With the separation between management and ownership, the role and integrity of management increased, as they were required to report to the increasing number of shareholders.

c) *The Railway Mania*

During the nineteenth century, management chose the accounting principles and practices to suit the goals of the organisation. As investors were persuaded of the profitability and returns in the railway industry,¹⁷ speculations in railway shares intensified. The speculation in railway shares in the UK reached a climax in the mid-1840's, a phenomenon known as the "Railway Mania" (Edwards, 1996:36).

In an uncontrolled accounting environment¹⁸ during the time of the Railway Mania, investors were exploited by manipulating accounting records to produce favourable reports and promises of large dividends¹⁹ (Edwards, 1996; McCartney & Arnold, 2010). According to McCartney and Arnold (2010:405) the overstatement of profitability "was mainly effected by abandoning the practice of charging depreciation". It was only at the beginning of the twentieth century that railway companies voluntarily started to recognise depreciation.

2.5.2 Demand for Regulation

a) *Regulation in the UK*

As dividend projections did not realise, investor confidence in the railway companies plummeted and the share prices of the railway companies fell on average by 64 per cent in the UK during the 1840's (Edwards, 1996). Demands for regulation resulted in the appointment of a government Select Committee on Joint Stock Companies in 1844, chaired by William Gladstone (Edwards, 1996). Based on the recommendations of the Select Committee, the Joint Stock Companies Act was passed in 1844 (Edwards, 1996). The Joint Stock Companies Act provided for the creation of an organisational entity. Limited liability, which is dominant in most financed business industries today, was introduced to the organisation entity in 1855 (Edwards, 1996). Regulation was not isolated to the UK. One of the trendsetters in regulation of accounting practices was Spain after 1848.

¹⁷ Profits were in the early stages of the railway industry much higher than the 3 per cent available on UK government securities (McCartney & Arnold, 2010). Campbell (2010) confirms that prices of railway shares were determined by fundamental factors such as dividends and growth risk.

¹⁸ Although Bryer (1991:439) argues that according to the "swindle hypothesis" the railway mania was "the product of a rational and rapacious social hierarchy, for whom accounting was simply a tool to be manipulated", the uncontrolled accounting environment favoured those accountants and managers who wanted to manipulate the accounting records.

¹⁹ It was stated in an editorial in The Times of 27 August 1866 that "Directors were often tempted to disregard all moral and legal obligations to make things look pleasant to their proprietors" (Edwards, 1989:117).

b) Regulation in Spain

The Spanish economic crisis of 1847-1848²⁰ also resulted in increased regulation of joint stock companies by the introduction of the Joint Stock Companies Act 1848 in Spain, that modified the Spanish Code of Commerce of 1829 (Llorens, 2000) . The Joint Stock Companies Act 1848 required that existing companies apply for re-authorization to continue as limited companies and that the accounts be inspected (Llorens, 2000). It does not seem as if rules were made to standardise accounting practices. Regulation was limited to re-authorization and inspection. Management's response was to perceive the inspection requirements as an intrusion of the principle of confidentiality. This led to some companies dissolving and pursuing business under a different legal entity (Llorens, 2000).

c) Response by business in the UK

Railway management in the UK responded to the Railway Mania during 1840-1855 by providing more information and by changing the conceptual basis of reporting (Edwards, 1996; McCartney & Arnold, 2010). Disclosure levels of financial reports increased and there were less variation in disclosure amongst the railway companies. Balance sheet disclosure increased during 1845-1850 and major advances in disclosure of income and expense were experienced between 1840-1845 (McCartney & Arnold, 2010).

d) Request for a standardised system of accounts after financial crisis

After another financial crisis in 1866, the Royal Commission on Railways in the UK requested a standardised system of accounts. As a result the "Regulation of Railways Act 1868 contained fifteen financial and statistical statements designed to improve comparability" (Edwards, 1996:65) and provide shareholders with information to assess the financial position of a company.

e) Fundamental accounting concepts emerge

The conceptual basis of reporting started to move from cash to an accrual basis with one of the leading companies, the London and North-Western Company, setting the example (McCartney & Arnold, 2010). Based on the financial report of The Staveley Coal and Iron Company Ltd, which is regarded as a fair example of financial reports during 1868, Edwards (1989:37) states that the following four fundamental accounting concepts were applied in preparing the financial statements. "Stock of goods ... was valued at cost or below. Expenditure on fixed assets was capitalised at cost. The depreciation charge was designed to recover the cost of fixed assets over their expected useful life", although not widely used before the twentieth century. "Revenue was recognised in accordance with the realisation concept and amounts owing to 'sundry persons' were accrued as liabilities."

²⁰ Llorens (2000:18–19) discusses the economic crisis from 1847-1848 in Spain.

f) Response: Increase in financial disclosure and establishment of fundamental concepts

The response to the Railway Mania was an increase in financial disclosure, the adoption of some accounting principles and the demand for objectivity (Salvary, 1979). Although there was progress in the disclosure of financial information between 1830 and 1900, accounting practices were not standardised (Edwards, 1989).²¹ By the end of the nineteenth century “the four fundamental concepts specified in the Statement of Standard Accounting Practices (SSAP) 2 (1971) – accruals, going concern, consistency and prudence – were already established” (Edwards, 1989:124–125).

In order to follow the development in accounting practices since the start of Industrial capitalism the following summary from 1760-1900 is provided.

Major accounting developments during the period 1760-1830 were:

- the transition from charge and discharge accounting²² to double-entry accounting²³ (Macve, 1996; Edwards, 1996);
- the development of cost management accounting²⁴ (Fleischman & Tyson, 1993; Gutiérrez, Larrinaga, & Núñez, 2005), due to the need to determine the cost of goods manufactured (Corns, 1996) and the valuation of inventories (Hendriksen & Van Breda, 1992);
- the concept of depreciation becoming more important, due to the increased cost of fixed assets (Edwards, 1996; Hendriksen & Van Breda, 1992);
- the introduction of the concept of capital protection or capital maintenance into the accounting world (Salvary, 1979). According to Salvary (1979) the concept of continuity implies permanence of capital for business that is a going concern and,
- lastly, the growing demand for financial reporting (Arnold & McCartney, 2008).

Accepted accounting practices by the end of the nineteenth century were:

- the adoption of the going concern concept (Edwards, 1989; Hendriksen & Van Breda, 1992);
- the historical cost concept being used to capitalise the cost of fixed assets (Edwards, 1996);
- a move from cash to accrual basis of accounting (Edwards, 1989; McCartney & Arnold, 2010);
- a selection of particular valuation procedures (Edwards, 1989);

²¹ Edwards (1989:119–122) discusses the inconsistency and bias of accounting practices between 1830-1900 referring to the Northampton Gas Light Company, Wigan Coal and Iron Co. Ltd and the Shelton Iron Steel and Coal Co. Ltd.

²² Littleton (1966:123–124) explains the use of the “charge-and-discharge Account (statement)”.

²³ The value of the double-entry system in the development of capitalism is treated in the academic discussion related to Sombart’s theory. For the purpose of this study, it is sufficient to say that the double-entry system was widely accepted at a stage of the economic development when the alternative methods could not provide the answers for the questions asked.

²⁴ Although there are evidence that costing techniques were already used before the Industrial Revolution the major development in costing methods can be traced to the early stages or just before the Industrial Revolution (Maria & Larrinaga-Gonzalez, 2001).

- the concept of prudence / conservatism (Edwards, 1989; Salvary, 1979);
- the adoption of depreciation accounting in some entities (Arnold & McCartney, 2002; Edwards, 1989);
- comparability (Edwards, 1996) and consistency (Edwards, 1989) of financial statements, and;
- the absence of general agreement on profit measurement and asset valuation procedures (Edwards, 1989).

2.6 Financial Capitalism: Corporate Capitalism and Verifiability, 1901 to 1938

The time between 1901 and 1938 is characterised by major events influencing the accounting profession and the accounting standard setting environment. The lessons learned from the Railway Mania, as listed above, were already incorporated in the accepted accounting practices. Although financial capitalism, with shares traded on numerous stock exchanges, was well established in the western world by the turn of the nineteenth century, accounting and financial reporting were struggling to keep up with developments on the business front. As the capital markets developed, the demands for verifiability increased. It took a major event, the Great Depression, as stimulus for the accounting profession to react and move from mainly being unregulated to a more structured and regulated profession during the period from 1901 to 1938. This section (section 2.6) focuses on the events surrounding the Great Depression and the impact of the Great Depression on financial reporting, changing it to a more regulated profession.

2.6.1 Financial Reporting Unregulated

Accounting practices in the United States was unregulated prior to 1930 (Evans, 2003; Wolk, Dodd, & Rozycki, 2013) and clarity was needed on some accounting problems. Some financial reporting structures were already functioning at the turn of the century. The accounting profession, consisting of professional accountants, was just emerging and still almost unknown outside of New York (Brown, 1905)²⁵.

a) *Need: disclosure of reliable financial data*

The accounting community was functioning without an accepted theoretical basis for accounting i.e. an accounting conceptual framework. Progress in the accounting domain was stimulated by mainly two factors: a major financial disaster on the economic front (the Great Depression of 1929) and, in reaction to the financial disaster, the introduction of regulation by means of legislation and accounting rules and standards by authorities, professional bodies and accounting organisations. The biggest areas requiring development were disclosure of financial data and the standardisation of accounting principles and practices (Wolk et al., 2013).

Basic accounting concepts like the calculation and allocation of depreciation, the responsibility for the valuation of stock (the auditors or management), the existence

²⁵ See Brown (1905) for a detail discussion on the formation and work of the AAPA.

of secret reserves and group accounts (Edwards, 1989) were some basic aspects that needed attention.

The increasing amount of money invested on the various stock exchanges, managements' promises of high dividend returns and capital growth combined with disappointing financial results, limited information in financial reports and finally, the collapse of the stock market in 1929 resulted in investors demanding verification of the credibility of financial reports. According to Salvary (1979) the investment community became concerned with accounting measurement and the stimulus to improve accounting measurement was the lack of guidance on corporate policy and financial reporting standards. "The accounting response was verifiability (auditing)" (Salvary, 1979:18).

b) *Reasons for and reaction to the stock market crash of 1929*

Although the stock market crash of 1929 and the Great Depression following the crash served as stimuli to improve financial reporting, financial reporting (or the lack of it) was not the primary reason for the stock market crash, but rather a culmination of U.S. government actions followed by irrational investor behaviour (Evans, 2003; Wolk et al., 2013).

The issuing of Liberty Bonds by the U.S. government to fund World War I was a turning point in share trading on the stock markets. The broad public was given the opportunity to invest in Liberty Bonds. The U.S. government made lump-sum repayments of the Liberty Bonds in the 1920s (Evans, 2003; Wolk et al., 2013) that made capital available for the public to invest.

During this time, the automotive industry started to boom and people who received lump sums from Liberty Bond repayments started to move their investments to the stock market to realise profits from stock trading. The result was the first modern stock market boom that unfortunately led to the stock market crash in 1929, which eventually culminated in the Great Depression (Wolk et al., 2013). Although there were some developments in financial reporting before the Great Depression, the financial crisis of the Great Depression stimulated the improvement in financial reporting.

c) *Reaction: financial reporting improved beyond legislation*

Regarding the effect on financial reporting, the balance sheet was still regarded as the most important financial report until the early twentieth century as is evident from the following remark by Sprague (1907:30): "The balance sheet may be considered as the groundwork of all accountancy, the origin and the terminus of every account".²⁶ Sprague does not discuss a formal "income statement". He discusses the "economic summary" which according to Sprague is "known in practice by various

²⁶ Sprague (1907) discusses two methods to construct a balance sheet, the "inventory" method and the "derivation" method.

names: Profit and Loss, Loss and Gain, Trading, Outlay and Income, Revenue” (Sprague, 1907:79) The economic summary or profit and loss account did not carry the status of a financial statement in 1908.

General Electric was a trendsetter in financial reporting and disclosure of financial information with its 1931 annual report.²⁷ The audited financial report consisted of a comparative Statement of Income and Expenses, a condensed Balance Sheet, detail on plant expenditures and notes on investments, foreign business, inventories, capital stock and pension plans (Evans, 2003). Although there was no uniformity in financial reporting, substantial improvements were made in the 1930s, even more than what the law required (Edwards, 1989). The motive for improvements was “that it enabled shareholders to be better informed” (Edwards, 1989:142). The improvement of financial reporting could partly be seen as a response to the financial crisis of 1929.

2.6.2 Development of the Accounting Profession

a) *Establishment of the accounting profession in the U.S.*

The establishment of an accounting profession in the U.S. started in 1886 when the American Association of Public Accountants (AAPA) was formed. On April 18, 1896 a bill, now known as the “C.P.A. Act”, was passed in the Senate and signed by the governor “to regulate the profession of public accountants” (Roberts, 1987:103) and became one of the Statute Laws of the State of New York. The “C.P.A. Act” created the professional designation of the “Certified Public Accountant” (CPA) (Wolk et al., 2013:65). The AAPA had a membership of 25 Fellows and 7 Associates in May 1889 (Brown, 1905). The *Journal of Accountancy* was founded by the AAPA in 1905. The AAPA appointed a committee on terminology, resulting in a list of terms and definitions that were adopted by the AAPA in 1915. The list of terms and definitions were expanded upon, resulting in the publication of 126 pages in the *Journal of Accountancy* in 1931 containing terms and definitions relevant to accounting and financial reporting (Wolk et al., 2013).

The AAPA was succeeded by the Institute of Public Accountants and changed its name to the American Institute of Accountants (AIA) in 1916 until 1957 when it changed to the American Institute of Certified Public Accountants (AICPA) (Wolk et al., 2013). In 1918, the AIA published a document titled “Approved Methods for the Preparation of Balance Sheet Statements” (Wolk et al., 2013). The document was used to conduct a balance sheet audit and was revised in 1929. In 1921, the American Society of Certified Public Accountants (ASCPA) formed under pressure from the New York State Society and acted as a federation of state societies (AICPA, 2015). In 1963, the ASCPA combined with the AIA and the Institute agreed to restrict its future members to CPAs (AICPA, 2015).

²⁷ Evans (2003:7–9) discusses the General Electric report in detail.

b) *Impact of the Great Depression on the accounting profession*

The Great Depression of 1929 had an impact on accounting with regards to professionalism and the lack of accounting principles in accounting (Gaffikin, 2008). According to Hendriksen (1970:29): “The formal presentation of accounting theory by authoritative bodies emerged with the events that followed 1930.” The first attempt to draft “accounting principles” on which “there is a fairly general agreement” (Storey & Storey, 1998) was done by the Special Committee on Cooperation with Stock Exchanges. According to Wolk et al. (2013:66) this cooperation between the New York Stock Exchange (NYSE) and the AIA led to the preparation of one of the most important documents in the development of accounting rule making to date. The formal draft of the “five broad accounting principles”²⁸, was approved by the NYSE on September 22, 1932 and is seen by Wolk et al. (2013:67) and Evans (2003:11) as the “first formal attempt to develop generally accepted accounting principles” (GAAP”).

The five principles were:

1. Unrealised profit should not be credited to net income.
2. Additional paid-in capital (capital surplus) should not be charged with items that are more appropriately charged to net income.
3. Retained earnings ...of a subsidiary should not be added to consolidated retained earnings.
4. In rare circumstances ...treasury stock may be considered an asset of the firm, but dividends on such shares should not be considered as revenue.
5. Officers’, affiliates’, and employees’ notes receivable should be separately disclosed (Evans, 2003; Gaffikin, 2008; Storey & Storey, 1998).

These principles were later incorporated as Chapter 1 of the *Accounting Research Bulletin* (Wolk et al., 2013). Zeff (2012) summarises the standardisation of accounting practices during this period as follows:

“While accounting guidance was provided by the organised United States accounting profession as far back as 1917 and again in the early 1930s, a programmatic approach to providing such guidance on a regular basis was not implemented until 1939.”

Another direct consequence of the Great Depression was the establishment of the Securities and Exchange Commission (SEC) by the U.S. Congress in 1934 (Gaffikin, 2008; Wolk et al., 2013). The purpose of the SEC was to administer the Securities Act of 1933 and the Securities and Exchange Act of 1934 (Wolk et al., 2013) to ensure full disclosure of accounting information by listed companies. The SEC had broad and specific authority “to prescribe the form and content of financial information filed with the SEC” (Wolk et al., 2013:67). According to the 1937 SEC commissioner, Robert Healy, the SEC had the authority to fix and maintain accounting standards. In order to avoid total government regulation of the accounting profession, the AIA

²⁸ According to Storey and Storey (Storey & Storey, 1998) the principles “had nothing in them that made them more basic or less concrete than conventions or rules.”

created the Special committee on Development of Accounting principles in 1933 (Evans, 2003; Wolk et al., 2013). The committee was inactive and replaced by the Committee on Accounting Procedure (CAP) in 1936. The CAP only started to be active in 1938.

c) Academic work on accounting theory

Important work from academia regarding accounting theory and accounting principles were done by Sprague (1907), Hatfield (1909) and Paton (1922) during the period from 1900 to 1938. At the turn of the century, the dominant theory regarding ownership was the proprietary theory that was supported by Sprague and Hatfield. Paton supported the entity theory as an alternative to the proprietary theory (Gaffikin, 2008).²⁹

Accounting academics interested in accounting education and research organised themselves by forming the American Accounting Association (AAA),³⁰ an influential academic body, in 1916. The purpose of the AAA is to develop worldwide excellence in accounting education, research and practice by way of leading-edge research and publications (AAA, 2015).

In 1936, the AAA published “*A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements*”, which was revised and reissued in 1944 and 1948 (Gaffikin, 2008; Storey & Storey, 1998). The report was criticised as departing too much from practice. In response another report was published by Sanders, Hatfield and Moore with the title “*A Statement of Accounting Principles*” (Gaffikin, 2008; Storey & Storey, 1998). This report provided a survey of current practices and did not reflect a systematic theoretical foundation (Storey & Storey, 1998). According to Gaffikin (2008:33) the search for “the establishment of a theoretical foundation for accounting” lasted for the rest of the century.

In summary, during the period 1900-1938 two factors stimulated the development of accounting: the Great Depression of 1929 to 1933 (Salvary, 1979) and in reaction thereto the formation of the SEC in 1934. The accounting profession responded with the list of five “accepted accounting principles” by the AIA in 1932 and the formation of the Committee on Accounting Procedure (CAP) in 1936 to provide better disclosure (Salvary, 1979). From a theoretical perspective, the proprietary theory and the alternative entity theory of accounting were formalised by Sprague and Hatfield and Paton respectively.

The search for a theoretical basis for accounting (conceptual framework), which had not been accomplished during this period, would become one of the most pressing accounting issues until 1973.

²⁹ See Gaffikin (2008:30–32) for a discussion on the difference between the proprietary theory and entity theory.

³⁰ See the history of the AAA from 1916 to 1966 in Zeff (1991).

2.7 Financial Capitalism: Professional Bodies' Search for Principles, 1938 to 1973

After the 1929-1933 Great Depression, corporate and market failures started playing an important role in the development of a theoretical foundation (conceptual framework) for accounting and financial accounting standards. During the period 1938 to 1973, authorities and accounting professional bodies responded to corporate and market failures by attempting to improve disclosure requirements and setting standards to address problems that were highlighted by a financial crisis or corporate failure, unfortunately on an ad hoc basis.

Zeff (1999:89) summarises efforts by the U.S. to develop a conceptual framework as follows:

“Institutional efforts in the U.S. to develop a conceptual framework for business enterprises can be traced to the Paton and Littleton monograph in 1940 and later to the two Accounting Research Studies by Moonitz and Sprouse in 1962-1963. A committee of the American Accounting Association issued an influential report in which it advocated a ‘decision usefulness’ approach in 1966, which was carried forward in 1973 by the report of the American Institute of CPAs’ Trueblood Committee. All of this laid the groundwork for the conceptual framework project of the Financial Accounting Standards Board (FASB), which published six concepts statements between 1978 and 1985.”

The actual development of a conceptual framework for accounting did not realise during this period following the initial search for accounting postulates and principles during the 1960s (Zeff, 1982), due to pressing demands to provide accounting answers caused by various financial crises. Work on a single accounting theory, to serve as basis for accounting standards, only commenced after the formation of the FASB in 1973. The developments leading up to the framework were all important milestones that contributed to the actual “product”.

2.7.1 Pressure from the SEC

a) *AIA and CAP issue ARB's*

The first initiative to set accounting standards was as a result of the SEC putting pressure on the AIA after the market failure of 1929. The AIA, in reaction to the pressure of the SEC, empowered the Committee on Accounting Procedure (CAP) in 1939 to issue accounting guidance, known as *Accounting Research Bulletins* (ARB) (Zeff, 2012). It was the intention of the CAP to develop a theory of accounting. Unfortunately, the CAP issued 51 ARB's without a theoretical basis (Storey & Storey, 1998) “to put out the fire” on an ad hoc basis until 1959 when the Accounting Principles Board (APB) was formed (Gaffikin, 2008:33). Problems experienced with the ARB's were that too many alternative accounting practices were allowed, a reluctance to condemn bad practices that were widely applied and that the work was done on an ad hoc basis as demanded by the SEC (Storey & Storey, 1998).

b) The APB replaces the CAP - publication of ARS1 and ARS3

In reaction to a speech by Alvin R. Jennings in 1957 at the AICPA's annual meeting, the approach to determine an acceptable accounting theory was changed (Evans, 2003). A conceptual approach had to replace the piecemeal method followed by the CAP (Wolk et al., 2013) and the Accounting Principles Board (APB) replaced the CAP. The Special Committee on Research Program recommended that financial accounting should receive attention on a hierarchy of four levels: "first, postulates; second, principles; third, rules or other guides ...; and fourth research" (Storey & Storey, 1998).³¹

The recommendations by the Special Committee on Research Program introduced a lot of discussion on accounting postulates and principles between 1957 and 1973 (Zeff, 1982).³² One of the first publications that followed was by The Accounting Research Division (ARD), the full-time research division of the APB. The ARD published Accounting Research Study No. 1 (ARS1): *The basic postulates of accounting* by Maurice Moonitz in 1961. During April 1962 the ARD published ARS3: *A Tentative Set of Broad Accounting Principles for Business Enterprises*, by Robert T. Sprouse and Maurice Moonitz (Gaffikin, 2008; Storey & Storey, 1998; Wolk et al., 2013).

c) ARS1 and ARS3 rejected

The professional accounting community rejected ARS1 and ARS3 and the APB remained under pressure from the SEC to give guidance on specific problems experienced in practice.³³

ARS1 and ARS3 were not accepted because the profession, SEC and APB members, felt that the principles in ARS1 and ARS3 were too radically different from the accounting practices relevant at that time and was too abstract and general (Wolk et al., 2013). One of the aspects where ARS1 deviated from the accounting practices of that period related to measurement. Sprouse and Moonitz advised on the use of current replacement cost for merchandise inventories and plant and equipment. They also recommended the use of discounted present values for receivables and payables and that gains or losses resulting from the revaluation of inventories should be taken to profit (Zeff, 1999).

The most obvious reason why ARS1 and ARS3 was not accepted was "the profession's inability to abandon historical costs" (Wolk et al., 2013:145) as historical cost was regarded as an objective measurement method. The measurement methods proposed in ARS1 and ARS3 had, according to the SEC, the potential to deceive the readers of financial statements (Zeff, 1999). Members of the APB expected an instrument supporting the *status quo* of accounting practices of the time

³¹ See Storey and Storey (1998) for a discussion on the differences between postulates, principles and rules.

³² The work of Zeff (1982) contains original documents from the discussion on postulates and principles between 1960–1963.

³³ A summary of the comments on ARS1 and ARS3 is provided in Evans (2003:58).

whilst Moonitz and Sprouse developed a framework for a “sound approach to financial reporting” (Zeff, 1999:94).

d) Reaction to the rejection of ARS1 and ARS3 – ARS5 and ASOBAT

As a result of the rejection of the postulates and principles proposed by Sprouse and Moonitz, the APB started to focus more on specific issues. On advice of Paul Grady and George O. May, that the theoretical basis for accounting should be derived inductively from practice, the APB published *Inventory of Generally Accepted Accounting Principles for Business Enterprises (ARS5)* in 1965 (Zeff, 1999). ARS5 was highly valued as it was seen as “an authoritative compilation of accepted U.S. practice” (Zeff, 1999:95). However, the study did not contribute to the improvement of accounting postulates and principles.

In reaction to the rejection of ARS1 and ARS3, the AAA took it upon itself to work on accounting theory and appointed a committee in 1964 to develop an integrated statement of basic accounting theory (Evans, 2003). In 1966, the AAA published “*A Statement of Basic Accounting Theory*” (ASOBAT). ASOBAT defined four standards for evaluating accounting information and five guidelines for communicating the information.” The four standards recommended are:

- relevance,
- verifiability,
- freedom from bias and,
- quantifiability.

Relevance was regarded as the primary standard and necessary for all accounting information.

The five communication guidelines are:

1. appropriateness to expected use,
2. disclosure of significant relationships,
3. inclusion of environmental information,
4. uniformity of practices within and among entities and,
5. consistency of practices through time (Evans, 2003:73; Wolk et al., 2013:186–194).³⁴

e) Seidman Committee

In May 1965 the Special Committee on Opinions of the APB (Seidman Committee) recommended that an authoritative identification of generally accepted accounting principles was essential for the work of a CPA (Storey & Storey, 1998; Briloff, 1966). Based on the recommendations of the Seidman Committee, the APB published Statement No. 4, *Basic Concepts and Accounting Principles Underlying Financial Statements of Business Enterprises* in October 1970 (Storey & Storey, 1998; Wolk et

³⁴ Evans (2003:74–77) discusses the essence of ASOBAT as well as the criticisms by Morrison, Sorter and Sterling on ASOBAT.

al., 2013). Statement No. 4 classifies objectives of accounting as particular, general and qualitative.

The general evaluation of Statement No. 4 was also not positive as, contrary to ARS1 and ARS5, it mostly stated principles distilled from experience that was already fifteen to twenty years old. Regardless of the negative evaluation, Storey and Storey (1998) listed at least five examples of what financial accounting ought to be in the future. According to Riahi-Belkaoui (2004:167) and Storey and Storey (1998) APB Statement No. 4 “has directly influenced both the Trueblood Report ... and *The Corporate Report* ... as well as the FASB’s attempts to develop a conceptual framework for financial accounting and reporting”.

In the end it is clear that the ARS project failed to provide an accounting theory with the non-acceptance of ARS1 and ARS3 (Evans, 2003) and according to Wolk et al. (2013) marked the end of the postulates-principles approach to standard setting in 1970 and the rise of objectives and standards.

2.7.2 Formation of the FASB

a) *The Wheat Committee*

It became clear that the APB was not effective and had to be replaced (Evans, 2003; Storey & Storey, 1998).³⁵ The most important problems were criticism of corporate financial reporting and the lack of a framework for developing accounting principles (Storey & Storey, 1998). In 1971 the AICPA reacted to the criticism and instructed the Wheat Committee to determine changes needed to get better and faster results. The primary function of the Wheat Committee was to establish the means and processes by which accounting principles should be established (Storey & Storey, 1998; Street, 1996; Wolk et al., 2013).³⁶ The Wheat Committee recommended the formation of FASB (Street, 1996).

b) *The Trueblood Report*

The AICPA appointed the Trueblood Committee in April 1971 to determine the objectives of financial reporting (Evans, 2003; Trueblood, Cyert, Davidson, Edwards, Gellein, et al., 1973).³⁷ The committee recommended Chapter 4 of APB Statement No. 4, *Basic Concepts and Accounting Principles Underlying Financial Statements of Business Enterprises* as a “logical starting point” to refine the objectives of financial statements (Wolk et al., 2013; Trueblood et al., 1973:67). The committee formulated

³⁵ Evans (2003:77–78) lists eight concerns during the time regarding the APB.

³⁶ See Wolk et al. (2013:78) for the specific recommendations made by the Wheat Committee and accepted by the AICPA’s council.

³⁷ The Trueblood Committee had to find answers to the following questions (Evans, 2003; Riahi-Belkaoui, 2004):

Who needs financial statements?

What information do they need?

How much of the needed information can be provided by accountants?

What framework is needed to provide the needed information?

12 objectives of financial accounting.³⁸ One of the most important recommendations by The Trueblood Report was that it recommended decision-usefulness as the basic objective of financial reporting, which was later accepted by the FASB in SFAC 1 (Evans, 2003; Street, 1996).

Chapter 11 of the Trueblood Report provides a summary of 12 objectives of financial statements:

1. “The basic objective of financial statements is to provide information useful for making economic decisions” (Trueblood et al., 1973:61).
2. “An objective of 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 principle source of information about an enterprise's economic activities” (Trueblood et al., 1973:62).
3. “An objective of 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” (Trueblood et al., 1973:62).
4. “An objective of financial statements is to provide users with information for predicting, comparing, and evaluating enterprise earning power” (Trueblood et al., 1973:62).
5. “An objective of financial statements is to supply information useful in judging management's ability to utilise enterprise resources effectively in achieving the primary enterprise goal” (Trueblood et al., 1973:63).
6. “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” (Trueblood et al., 1973:63).
7. “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” (Trueblood et al., 1973:64).
8. “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

³⁸ Evans (2003:86–87), Wolk et al. (2013:197–204) and Riahi-Belkaoui (2004:167–173) discuss the twelve objectives for financial reporting as expressed in the Trueblood Report.

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” (Trueblood et al., 1973:64).

9. “An 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” (Trueblood et al., 1973:64).
10. “An objective of financial statements is to provide information useful for the predictive process. Financial forecasts should be provided when they will enhance the reliability of users” predictions” (Trueblood et al., 1973:65).
11. “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” (Trueblood et al., 1973:66).
12. “An objective of financial statements is to report on those activities of the enterprise affecting society which can be determined and described or measured and which are important to the role of the enterprise in its social environment” (Trueblood et al., 1973:66).

The Trueblood Report also mentions the following qualitative characteristics: “relevance and materiality, reliability, freedom from bias, comparability, consistency, understandability, and the recognition of substance over form” (Trueblood et al., 1973:66).

A new era commenced in financial reporting with the formation of the FASB. Table 2.1 summarises the most important documents that contributed to the FASB conceptual Framework.

Table 2.1: Historical documents contributing to the FASB conceptual framework³⁹

Date	Author / Organisation	Document	Significance of document
1922	W.A. Paton	Accounting Theory	<ul style="list-style-type: none"> Restatement of the theory of accounting for conditions and needs of business enterprises. Discussion on postulates.
1929	J.B. Canning (Ph.D. student of Paton)	The economics of Accountancy	<ul style="list-style-type: none"> Present a conceptual framework for asset valuation and measurement on future expectations.
1936 (revised 1941, 1948, 1957)	AAA	A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements	<ul style="list-style-type: none"> Assumption: a corporation's periodic financial statements should be continuously in accord with a single coordinated body of accounting theory. Argue for the use of historical cost accounting. Twenty principles by which to evaluate rules and procedures. Highly regarded by the SEC.
1938	T.H. Sanders, H.R. Hatfield, U. Moore	A Statement of Accounting Principles	<ul style="list-style-type: none"> Survey of current practices of accountants. First relatively complete statement of accounting practices. Reluctant to criticise dubious practices.
1938 - 1958	AIA task CAP	Publish 51 Accounting Research Bulletins (ARB)	<ul style="list-style-type: none"> Serve as guidance for SEC on ad hoc basis. Decide not to develop a comprehensive statement of accounting principles. Lack of statement of accounting principles lead to dissolution of CAP. Allowed too many alternative practices.
1940	W.A. Paton, A.C. Littleton	An Introduction to Corporate Accounting Standards	<ul style="list-style-type: none"> Influenced by A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements. Influential in establishing historical cost accounting as principle in the U.S. Popularise "matching" of costs and revenue. Rejected LIFO and lower of cost or market value in valuation of inventories.
1958	APB	Report of Special Committee on Research Program	<ul style="list-style-type: none"> Financial accounting to be addressed at four levels: postulates, principles, rules or other guides
1961	APB	ARS1 The Basic Postulates of	<ul style="list-style-type: none"> Widely criticised.

³⁹ The information presented is a summary of the previous work and summarized from (Zeff, 2002; Wolk et al., 2013; Evans, 2003; Gaffikin, 1987).

Date	Author / Organisation	Document	Significance of document
	(M. Moonitz)	Accounting	<ul style="list-style-type: none"> Retained historical cost.
1962	APB (R.T. Sprouse and M. Moonitz)	ARS3. A Tentative Set of Broad Accounting Principles for Business Enterprises	<ul style="list-style-type: none"> Postulates not complete. No mention of outside users of financial data. Objectives of published financial statements not set. Seen as first attempt in US by the practicing arm of the profession to provide a conceptual basis for rule-making (Wolk et al., 2013).
1965	APB (P Grady)	Inventory of Generally Accepted Accounting Principles for Business	<ul style="list-style-type: none"> Theoretical explanations should be derived inductively from practice. Seen as an authoritative compilation of accepted U.S. practice.
1966	AAA	A Statement of Basic Accounting Theory (ASOBAT)	<ul style="list-style-type: none"> Break from previous statements. Accounting theory is descriptive and normative in nature. Theory defined as: "a cohesive set of hypothetical, conceptual and pragmatic principles forming a general frame of reference" (Wolk et al., 2013:187). Objective of accounting is decision usefulness of accounting information for external users. "Four basic standards for accounting information: relevance, verifiability, freedom from bias, and quantifiability". Accounting reports do not make predictions. Managerial needs differ from those of external users. Stewardship functions to society as a whole. Provides guidelines for communicating accounting information. Historical cost v. current value - accept both models.
1970	APB	ARS4: Basic Concepts and Accounting Principles Underlying Financial Statements of Business Enterprises.	<ul style="list-style-type: none"> Purpose was to state fundamental concepts of financial reporting. Linked with ASOBAT regarding decision-usefulness and the diversity of users of Financial Statements. Defined assets, liabilities, owners' equity, revenues and expenses as the basic elements of financial accounting. Stated qualitative objectives: relevance, understandability, verifiability, neutrality, timeliness, comparability and completeness.

Ch 1

Ch 2

Ch 3

Ch 4

Ch 5

Ch 6

Ch 7

Ch 8

Ch 9

Ch 10

Date	Author / Organisation	Document	Significance of document
1972	Arthur Andersen & Co.	Objectives of Financial Statements for Business Enterprises	<ul style="list-style-type: none"> • Critical of conservatism and historical cost as a goal. • Financial statements must be fair to all users and should provide the basis for resolving conflicting interests (Zeff, 1999). • Assets should be valued at current value. • Unrealised gains and losses to be disclosed in the income statement.
1973	AICPA	Objectives of Financial Statements (Trueblood Report)	<ul style="list-style-type: none"> • Adopts decision-usefulness from ASOBAT. • Provides 12 objectives of financial accounting. • FS should serve those users who have limited authority, ability or resources to obtain information. • Focuses more on future cash flows than ASOBAT. • Qualitative characteristics: relevance and materiality, form and substance, reliability, free from bias, comparability, consistency and understandability. • Valuation basis to be used: historical cost, exit values, current replacement cost, and discounted cash flow. • Social objective: report on activities affecting society that can be determined and described or measured, citing pollution as an example.

2.8 Financial Capitalism: Global Capital Markets: 1973 to the Present

During 1973, accounting standard setting changed on both sides of the North Atlantic Ocean. The recommendations of the Wheat Committee resulted in the dawn of a new era of standard setting in the U.S. with the formation of the new tripartite, structure the Financial Accounting Foundation (FAF), the Financial Accounting Standards Advisory Council (FASAC) and the FASB of standard setting in 1973. The stimulus behind the restructuring was to adhere to pressure from the SEC to provide guidance regarding financial reporting.

The main objective of the SEC since its formation in 1934 has been to protect investors and try and avoid market failures by guarding against misleading financial statements (Zeff, 1999). Although fear of market and corporate failures⁴⁰ were an important stimulus behind the development of accounting principles and accounting standards in the U.S., it is clear that the U.S. already started in the late 1950s and early 1960s to attempt to develop accounting and reporting standards on an international basis (FASB, 2014a).

Also in 1973, the international accounting community on the Western shores of the Atlantic Ocean responded to the growing internationalisation of capital markets with the formation of the International Accounting Standards Committee (IASC) under Sir Henry Benson, with a head office in London due to a need for global harmonisation of accounting standards (Camfferman & Zeff, 2009).

Back in the U.S., the AAA reconsidered the accounting theory in ASOBAT and published *A statement on accounting theory and theory acceptance* (SATTA) in 1977. The original task assigned in 1973 was to update ASOBAT, but due to big changes to accounting after its release the various committees decided to focus on these situations as they changed after ASOBAT (Evans, 2003).

In contrast to the optimistic view about a single accounting theory in ASOBAT, SATTA portrayed pessimism to create a single accounting theory as various previous attempts failed (Gaffikin, 2008). SATTA is however valuable in the sense that it surveyed the accounting theory literature and provided a summary of the work of many accounting theory writers (Evans, 2003; Gaffikin, 2008). After considering the literature theory at the time, the committee concluded that no single theory for accounting existed.⁴¹ The release of the SATTA report in 1977 was discouraging for the FASB that was busy searching for a single accounting theory on which to base new accounting standards at the time.

⁴⁰ Reinhart and Rogoff (2009) defines crises by (a) quantitative thresholds: inflation, currency crashes and debasement, and (b) events: banking crises, external and domestic default.

⁴¹ Evans (2003:131–135) discusses the reason why SATTA believed there cannot be a single accounting theory in the light of Kuhn's view on scientific paradigms and scientific revolutions.

2.8.1 Financial Capitalism: The Conceptual Framework (FASB), 1973 to 1999

In 1973, the FASB initiated a conceptual framework project. The FASB concluded that “accounting did possess a core of fundamental concepts that were neither subject to, nor dependent on the moment’s particular, transitory consensus” (Storey & Storey, 1998). The idea of the conceptual framework was to guide the FASB in establishing accounting standards.

a) *Statement of Financial Accounting Concepts (SFACs)*

The FASB’s conceptual framework project comprised of six parts published as the *Statement of Financial Accounting Concepts* (SFACs). The FASB conceptual framework project is generally regarded as an evolutionary project. In December 1985, twelve years after the start of the project, SFAC No. 6 *Elements of Financial Statements* replacing SFAC No. 3 (*Elements of Financial Statements of Business Enterprises*) and amending SFAC No. 2 (*Qualitative characteristics of Accounting Information*), was published. The next publication was in 2000 with the publication of SFAC No. 7 *Cash flow information and present value in accounting measurements*.⁴²

The following is a summary of the publication of the SFAC’s by the FASB:

- SFAC No. 1 (1978): Objectives of Financial Reporting by Business enterprises.
- SFAC No. 2 (1980): Qualitative characteristics of Accounting Information.
- SFAC No. 3 (1980): Elements of Financial Statements of Business Enterprises.
- SFAC No. 4 (1980): Objectives of Financial Reporting by Nonbusiness Organizations.
- SFAC No. 5 (1984): Recognition and Measurement in Financial Statements of Business Enterprises.
- SFAC No. 6 (1985): Elements of Financial Statements. (Replacing SFAC No. 3, and incorporating SFAC No. 2)
- SFAC No. 7 (2000): Using Cash Flow information and Present Value in Accounting Measurements.
- SFAC No. 8 (2010): Conceptual Framework for Financial Reporting. (Replacing SFAC No. 1 and No. 2).

b) *The Stamp Report*

The accounting community had mixed reactions to the FASB conceptual framework publications. In its reaction, the Canadian Institute of Chartered Accountants (CICA) published a research study in June 1980 entitled *Corporate Reporting: Its Future Evolution*, also known as the “*Stamp Report*”. According to the Stamp Report the

⁴² The progress and publication of the different SFAC’s are discussed in detail by Evans (2003:146–162), Gaffikin (2008:105–115), Riahi-Belkaoui (2004:chap. 6), Storey and Storey (1998) and Wolk et al. (2013:225–256).

FASB conceptual framework was not “suitable for Canada given the environmental, historical, political and legal differences between the United States and Canada” (Riahi-Belkaoui, 2004:192). At the end of the Stamp Report a conceptual framework project for Canada was proposed, based on an evolutionary approach (Riahi-Belkaoui, 2004). In general, mixed opinions were however expressed on the different SFAC’s as they were published.

c) *Opinions of the SFAC’s*

People’s expectations of the conceptual framework determined their reactions. SFAC No. 5 on recognition and measurement was the biggest disappointment, as it did not provide any clarity on the use of historical cost as basis for measurement, thus confirming the status quo without any guidance. The disappointment in SFAC No. 5 was so widespread that the whole project was seen as a failure by some respondents (Zeff, 1999).⁴³

Storey and Storey (1998:161) concluded their assessment of the FASB conceptual framework as follows:

“Despite the fact that the Board has left it incomplete, the FASB’s conceptual framework:

- is the first reasonably successful effort by a standards-setting body to formulate and use an integrated set of financial accounting concepts
- has fundamentally changed the way financial accounting standards are set in the United States
- has provided a model for the International Accounting Standards Committee and several national standards-setting bodies in other English- speaking countries, which not only have set out their own concepts but also clearly have been influenced by the FASB’s Concepts Statements, sometimes to the point of adopting the same or virtually the same set of concepts.”

However, Zeff’s (1999:122) assessment on the value of the FASB’s conceptual framework is less favourable:

“This writer would interpose three reactions to the views expressed by Storey and Storey. (1) Without question, the board has shown that it can bring an immense project of this kind to completion, but whether the effort has been ‘reasonably successful’ is still an open question. Looking back, keeping in mind that the IASB in large adopted the FASB’s conceptual framework, as well as the joint project between the FASB and IASB that

⁴³ Zeff (Zeff, 1999) discusses the reactions of Richard Macve, David Solomons, Kenneth Most, Mike Davies et al., Simon Archer, Kevin Stevenson, Arthur Andersen, Robert Sterling, K.V. Peasnell, the AAA, Nicholas Dopuch, Shyam Sunder and R.K. Storey and S. Storey on the FASB conceptual framework.

built on the FASB and IASB CF's, it can be concluded that the FASB conceptual framework project was a success. (2) One doubts that the board's approach to setting standards has been 'fundamentally changed' by the conceptual framework — changed, yes, but not fundamentally. (3) It is true that the board's conceptual framework has been imitated in other countries and by the International Accounting Standards Committee (IASC). But the IASC's framework is no more helpful on measurement than is the FASB's Statement 5."

In assessing the value and contribution of the FASB's conceptual framework the two most negative aspects clearly are: (1) the failure of SFAC No. 5 to provide clarity on recognition and measurement and continuing with historical cost as basis for measurement and, (2) the lack of status to influence the revision and setting of accounting standards.

On the lack of status Wolk et al. (2013:225) are of the following opinion:

"It is somewhat difficult to take this project seriously, despite all the time, money and effort spent on it, when in the preface of each of the standards the Board declares that SFACs do not (a) require a change in existing general accepted accounting principles; (b) amend, modify, or interpret statements of Financial Accounting Standards; or (c) justify either changing existing generally accepted accounting and reporting practise..."

The same qualification quoted above is still present in the foreword of FASB SFAC No. 8, *Conceptual Framework for Financial Reporting*, 2010. SFAC No. 8 is the result of the joint project with the IASB, replacing FASB Concepts Statements No. 1 and No. 2 (FASB, 2010a). The question is, what would cause the FASB to change its qualification or improve the status of the Conceptual Framework? An inherently consistent and unambiguous conceptual framework of the financial reporting domain, accepted by the broad accounting community? Due to the development in the global capital markets, the accounting profession in Europe also started a search for globally acceptable accounting standards.

2.8.2 Financial Capitalism: The Conceptual Framework in Europe, 1973 to 2002

a) *Stimulus: Global capital market*

The same year that the FASB was formed (1973), the accountancy profession, under the leadership of Sir Henry Benson, responded to the growing internationalisation of capital markets with the formation of the International Accounting Standards

Committee (IASC).⁴⁴ The IASC was officially formed on 29 June 1973 when an Agreement and a Constitution were signed (Camfferman & Zeff, 2009). The objective of the IASC was “to formulate and publish in the public interest, basic standards to be observed in the presentation of audited accounts and financial statements and to promote their worldwide acceptance” (Camfferman & Zeff, 2009:51). The motivation behind the formation of the IASC was to harmonise accounting standards in the growing international market.

Dunning and Pearce (1995:22–43) indicated the growth in multinational enterprises (MNE) from 1870 to 1990 and illustrated the explosion of global economy. During the 1990’s, the importance of the impact of differences in financial reporting between countries is summarised by Nobes (1995:57) as follows: “What is clear is that readers could be seriously misled if they compared financial statements from apparently similar companies from various countries: the differences in asset valuation and profit measurement are very great”. Against the background of growing MNE’s and international economic integration, the IASC came into existence with the purpose of harmonising financial reporting differences (Camfferman & Zeff, 2009). An example of the need for harmonisation is the listing of Daimler-Benz on the New York stock exchange in 1993. Under German GAAP Daimler-Benz made a profit of DM 615 million while under U.S. GAAP the same company made a loss of DM 1 839 million (Camfferman & Zeff, 2009).

The first call for “uniformity of accounting practices” was made in 1957 at the Seventh International Congress of Accountants in Amsterdam by the president Jacob Kraayenhof (Camfferman & Zeff, 2009; Kraayenhof, 1960). Kraayenhof (1960:35) argued that a principle should be “based on economically and theoretically sound valuation and profit concepts.” The IASC published its first standard, *Disclosure of Accounting Policies*⁴⁵ IAS 1 in January 1975. Sir Henry Benson, the chairperson at that stage, commented that the publication of the standard might be seen as a “turning point” in the accounting profession (Camfferman & Zeff, 2009:95).

b) Different stimuli between Europe and the U.S.

The stimulus in Europe to set accounting standards under the IASC differs from the stimulus in the U.S. In the U.S. the SEC played, initially after the Great Depression, a decisive role in motivating the accounting community to set accounting standards. The stimulus in Europe was the growth in MNE’s and need for comparative financial information across international borders. The response was the search of the accountancy profession, under the leadership of the IASC, to “harmonize vastly different accounting practices across countries” (Camfferman & Zeff, 2009:1).

⁴⁴ The founding countries of the IASC at a meeting of the ICAEW were: Australia, Canada, France, Germany, Japan, Mexico, the Netherlands, the United Kingdom and Ireland and the United States (Camfferman & Zeff, 2009).

⁴⁵ The title of IAS 1 changed in 1997 to *Presentation of Financial Statements*.

c) Pressure to develop a conceptual framework

As the setting of standards was the most urgent point on the agenda, the IASC only later considered the use of a conceptual framework to guide it in setting standards. The Board officially considered a conceptual framework project on an international level in 1979. At first, the Board was reluctant to publish a conceptual framework as an official document, but a U.S. comment letter in 1978 on the IASC foreign currency translation project stated that progress by the IASC projects was unlikely “without some explicit or implicit framework of objectives for the financial statements” (Camfferman & Zeff, 2009:254). In April 1979, the IASC admitted that it does not have a conceptual framework project on its agenda as it was waiting to see how the FASB’s framework project would develop. However, in 1979, the Chairman John Hepworth announced that the Board would consider a conceptual framework project (Camfferman & Zeff, 2009).

d) Evolution of the IASC conceptual framework

The development of the IASC conceptual framework followed an evolutionary path. The Initially, in 1983 and 1984, the Board had a “fill the gap” approach to the existing framework. The existing framework was referred to by the IASC as not a separate document such as the FASB’s Statement of Financial Accounting Concepts, but a “framework of Standards” (Camfferman & Zeff, 2009). The “framework of Standards” referred to “the implicit structure and internal consistency of the extant IASC Standards” (Camfferman & Zeff, 2009:255) The recommendation by the Board to the steering committees was in terms of filling the gaps in the existing “framework of Standards”. The gaps identified in 1983 were related to “*Owners’ Equity, Liabilities, Assets/Expenses – Definition and Recognition, Purchased Goodwill*” (Camfferman & Zeff, 2009:255). In 1984, the IASC board agreed to set up steering committees on liabilities and owners’ equity. The “filling the gap” approach evolved into a “building block” approach.

The building blocks that evolved from the “filling the gap” approach were “Objective of Financial Statements, Liabilities, Owners’ Equity, and Assets and Expenses”. In the first building block, the committee adopted the ideas from SFAC 2 “*Qualitative Characteristics of Accounting Information*” published by the FASB, to suit the views of the IASC. The IASC proposed relevance and reliability as basic qualitative characteristics reflecting the ideas of SFAC 2. The IASC suggested a broader user base than the FASB when the IASC expanded “economic and decision-making” with “accountability” as a fundamental objective. The last building block, “Assets and Expenses” project started in June 1985.

e) *Single conceptual framework project*

Eventually in 1986 the “building block projects were combined into a single project to prepare a framework document” (Camfferman & Zeff, 2009:256).⁴⁶ In November 1986, a new steering committee was tasked to draw up a conceptual framework in a separate document. After some draft versions, the first final single document of the conceptual framework of the IASC was published in 1989.

Although there were some differences between the FASB’s conceptual framework and the conceptual framework published by the IASC in 1989, the IASC conceptual framework strongly corresponds with SAFC No. 1, 2, 3 and 5 (Agrawal, Jensen, Meador, & Sellers, 1989; Wolk et al., 2013). The steering committee wanted the IASC conceptual framework to be seen as including elements from different accounting traditions, but the similarities with the FASB conceptual framework overshadowed the differences. The differences related to emphasis given to “reporting on stewardship, the true and fair view, prudence and maintenance of physical capital” (Camfferman & Zeff, 2009:261).

The CFIFR built on the FASB conceptual framework and can be viewed as a continuation of the development and evolution of accounting concepts from the past. From the start of the first accounting practices (sections 2.2.1 and 2.2.2), the main purpose of accounting was to manage assets on behalf of the state and landlords. It is also a continuation of the concepts that developed with the introduction of companies and investors, and the separation of ownership and management of a business. The need for financial reporting to investors and shareholders was a direct consequence of the separation of ownership and management and evolved with the growth and expansion of shareholding to the public in the twentieth century.

The publication of the IASC Conceptual Framework brought the accounting community closer to the ideal of globally acceptable accounting standards, as it provided a theoretical basis in the international community that was very close to the accounting reference basis of the United States of America. In order to provide globally acceptable financial accounting standards, one of the most basic requirements is that standard setters should use the same theoretical basis. The next step in setting globally acceptable accounting standards from the same theoretical basis was therefore for the FASB and the IASB to work together on a conceptual framework.

⁴⁶ Camfferman and Zeff (2009:253–264) discuss the work done on the building blocks and the Framework project in detail.

2.8.3 Financial Capitalism: The Joint FASB and IASB Conceptual Framework Project, 2002 to 2010

a) *In the beginning*

Based on the FASB website with the title “International convergence of accounting standards – a brief history” (FASB, 2014a) it can be accepted that harmonisation and convergence of accounting standards were always on the agenda of the FASB, with numerous joint projects between the FASB and other accounting standard setting bodies. According to the FASB (2014a:1) “the concept of convergence first arose in the late 1950s in response to post World War II economic integration and related increases in cross-border capital flows.”

One of the biggest hurdles for convergence of accounting standards was the SEC’s reluctance to accept the use of financial statements prepared from foreign accounting standards. Although there were still some questions asked by the SEC, the SEC’s Concept Release, *International Accounting Standards* on 16 February 2000, officially opened doors for the convergence of accounting standards. The SEC encouraged the IASC and the FASB to converge their standards (Camfferman & Zeff, 2009). In 2001, the IASC reconstructed into the IASB and in 2002 the European Union passed a regulation that required all listed EU companies to apply International Financial Reporting Standards (IFRS’s) for fiscal years starting 1 January 2005 (Soderstrom & Sun, 2007).

b) *The Norwalk Agreement*

With “The Norwalk Agreement” on 18 September 2002 (FASB and IASB, 2002), the FASB and the IASB agreed on a shared goal of developing compatible, high-quality accounting standards that could be used for both domestic and cross-border financial reporting. The FASB and the IASB agreed to:

- a) “undertake a short-term project aimed at removing a variety of individual differences between U.S. GAAP and International Financial Reporting Standards (IFRS’s, which include International Accounting Standards, IASs);
- b) remove other differences between IFRS’s and U.S. GAAP that will remain at January 1, 2005, through coordination of their future work programs; that is, through the mutual undertaking of discrete, substantial projects which both Boards would address concurrently;
- c) continue progress on the joint projects that they are currently undertaking; and,
- d) encourage their respective interpretative bodies to coordinate their activities.” (FASB and IASB, 2002:1).

As a result of The Norwalk Agreement the FASB and IASB “added to their agendas a joint project to develop an improved, globally acceptable conceptual framework that builds on their existing frameworks” (FASB, 2014b). The purpose of the project is to:

1. “Focus on changes in the environment since the original frameworks were issued, as well as omissions in the original frameworks, in order to efficiently and effectively improve, complete, and converge the existing frameworks.
2. Give priority to addressing and deliberating those issues within each phase that are likely to yield benefits to the Boards in the short term; that is, cross-cutting issues that affect a number of their projects for new or revised standards. Thus, work on several phases of the project will be conducted simultaneously and the Boards expect to benefit from work being conducted on other projects.
3. Initially consider concepts applicable to private sector business entities” (FASB, 2014b).

Halsey G. Bullen, FASB Senior Project Manager and Kimberley Crook, IASB Senior Project Manager wrote a paper in May 2005 announcing that the FASB and IASB are jointly revisiting their respective conceptual frameworks (Bullen & Crook, 2005). The need for the project is stated by Bullen and Crook (2005:1) as follows: “...the common goal of the FASB and IASB ... is for their standards to be “principles-based”, ... rooted in fundamental concepts. The fundamental concepts need to constitute a framework that is sound, comprehensive and internally consistent.” This statement by Bullen and Crook forms the basis of the research questions formulated in section 3.2.

c) *The September 28, 2010 Conceptual Framework for Financial Reporting (CFfFR)*

On 28 September 2010, the FASB and IASB completed the first stage of the joint conceptual framework project that deals with the objective and qualitative characteristics of financial reporting. The IFRS foundation published a document with the title “*The Conceptual Framework for Financial Reporting*” (IASB, 2010a) which consists of an introduction and four chapters. The approval of the Board, basis for conclusions on chapters one and three and a table of concordance was published in Part B of the 2010 edition of the IASB’s Conceptual Framework for Financial Reporting.

The revised Chapter 1 consists of an introduction providing the purpose, status and scope of the CFfFR. In Chapter 1 (par. OB1-OB11) the objective of general purpose financial reporting is stated. The objective is in line with the 1989 version of the CFfFR and the Trueblood report as “to provide financial information ... that is useful to existing and potential investors, lenders and other creditors in making decisions about providing resources to the entity” (IASB, 2010a:par. OB2).

The 1989 CFfFR was less specific regarding the users. The users in the 1989 CFfFR described as “a wide range of users in making economic decisions” (IASB, 1989). The basic principle of decision-usefulness as objective for financial statements had already been part of Pacioli’s motivation to publish the *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* (see section 2.2.2).

In paragraphs OB12-OB16 the basic concepts of and changes in economic resources and claims are discussed. Financial performance of an entity is reflected by the concepts of accrual accounting and past cash flows (par. OB17-OB20). In paragraph OB21 it is stated that an entity’s economic resources and claims may change for reasons other than financial performance, such as the issue of ownership shares.

Chapter 2, “The Reporting Entity”, is still outstanding. The concept “Reporting Entity” is one of the key concepts in financial reporting. The importance of the concept is highlighted by the objective of the CFfFR where it is stated that “the objective of general purpose financial reporting is to provide financial information about the reporting entity” (IASB, 2010a:OB1). In 2010 the IASB published an exposure draft (ED/2010/2) on the Reporting Entity chapter of the CFfFR (IASB, 2010b). In ED/2010/2 (IASB, 2010b:RE2) a reporting entity is defined as follows:

“A reporting entity is a circumscribed area of economic activities whose financial information has the potential to be useful to existing and potential equity investors, lenders and other creditors who cannot directly obtain the information they need in making decisions about providing resources to the entity and in assessing whether management and the governing board of that entity have made efficient and effective use of the resources provided.”

In Chapter 3, the qualitative characteristics of useful financial information are discussed. A very important difference between the 2010 CFfFR and the 1989 CFfFR with regards to the qualitative characteristics is that the qualitative characteristics in the 2010 CFfFR are split between fundamental and enhancing qualities, while that was not the case in the 1989 CFfFR.

In the 2010 CFfFR, Chapter 4 consists of the remaining text from the IASB’s 1989 version, known as “**The Framework**”, namely (IASB, 2010a):

Underlying assumption.

Financial statements are prepared on the assumption that an entity will be a going concern in the foreseeable future.

The Elements of Financial Statements.

In paragraphs 4.4-4.23 (IASB, 2010a), the definitions of the elements of the statement of financial position i.e. asset, liability and equity are presented and

discussed. The measurement of performance and the elements of income and expenses are defined and discussed in paragraphs 4.24-4.35 (IASB, 2010a). Capital maintenance adjustments are addressed in paragraph 4.36.

Recognition of the elements of financial statements.

The different elements in financial statements can be recognised in financial statements if there is a probability of future economic flow and if the value can be measured with reliability (IASB, 2010a:par. 4.37–4.53).

Measurement of the elements of financial statements.

The four different measurement bases provided and discussed are: (a) historical cost, (b) current cost, (c) realisable (settlement) value and, (d) present value. In the discussion on the development of a conceptual framework, historical cost as measurement basis was constantly criticised by various authors as not sufficient to reflect the business reality of an enterprise. At the same time, it was the only basis supported by the SEC. In paragraph 4.56 (IASB, 2010a) it is stated that “the measurement basis most commonly adopted by entities in preparing financial statements is historical cost.” Measurement is a contentious topic, and is under revision with the IASB’s conceptual framework project of 2013 to 2015.

Concepts of capital and capital maintenance.

The concept of capital is synonymous with the equity of an entity. In the discussion of the historical development of accounting concepts, it was indicated that Hugh Oldcastle (see section 2.3.2) developed the concept of continuity of capital in 1543. In paragraph 4.59 (IASB, 2010a), financial capital maintenance and physical capital maintenance concepts are explained. Capital maintenance provides the link between the concepts of capital and profit.

In order to trace the development of the qualitative characteristics between the 1989 and 2010 conceptual frameworks, a summary of the qualitative characteristics is provided. See the table below for a comparison of the qualitative characteristics between the 1989 CFfFR and the 2010 CFfFR.

Table 2.2: Comparison of qualitative characteristics between the 1989 CFfFR and the 2010 CFfFR

1989 CONCEPTUAL FRAMEWORK	2010 CONCEPTUAL FRAMEWORK
(No indication of fundamental or enhancing qualitative characteristics)	Fundamental qualitative characteristics
Understandability	
Relevance <ul style="list-style-type: none"> • Materiality 	Relevance <ul style="list-style-type: none"> • Materiality
Reliability <ul style="list-style-type: none"> • Faithful representation • Substance over form • Neutrality • Prudence • Completeness 	Faithful representation
	Applying the fundamental qualitative characteristics (paragraphs QC 17 and QC 18 is explaining how to apply the fundamental qualitative characteristics)
	Enhancing qualitative characteristics
Comparability	<ul style="list-style-type: none"> • Comparability • Verifiability • Timeliness • Understandability
Constraints on relevant and reliable information <ul style="list-style-type: none"> • Timeliness • Balance between benefit and cost • Balance between qualitative characteristics 	The cost constraint on useful financial reporting.

The differences between the two conceptual frameworks are not discussed further as the primary purpose of this study is not to discuss or explain the differences or the implication of the differences between the respective CFfFRs. The purpose for Chapter 2 of the study is to provide an indication of the development of the concepts as found in the 2010 CFfFR.

Although the joint conceptual framework project was suspended on 17 November 2010 (FASB and IASB, 2010), the IASB decided on a meeting in May 2012 to continue with the conceptual framework project. The IASB proceeded with the conceptual framework project without the FASB, thus ending the official joint project on the conceptual framework between the FASB and the IASB (IASB, 2012a; IASB, 2012b). The IASB published a discussion paper called: *A Review of the CFfFR* on the remaining parts of the conceptual framework project during July 2013 (IASB, 2013a).

As the 2010 CFfFR published by the IASB is the last completed document providing a conceptual framework for financial reporting, this study will use the IASB CFfFR of 2010 as basis to build the formal ontology.

2.9 Summary of the Historical Development of the IASB's CFfFR

Over the ages, the function of accounting was generally agreed to be the satisfaction of the need for information of society. While the need(s) was satisfied between 1500-1830, the system experienced homeostasis (Salvary, 1979) and very little development was needed regarding accounting information. However, if something in the environment changes, the system is in turbulence and a new need is experienced. The system will stay in turbulence until the accounting response satisfies the new need. Different types of activities have an influence on society that serves as a stimulus in need of a response.

Table 2.3 provides a summary of stimuli and responses identified during the discussion of the history of accounting that had an influence on the development of accounting practices, accounting theory and the 2010 IASB, CFfFR.

Table 2.3: Summary of stimuli and response in the development of the CFfFR

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
4000 B.C. – 1000 A.D.	Pre-capitalist period	Need to control resources		
3350 B.C. – 1900 B.C.	Public Economy: Mesopotamia	<ul style="list-style-type: none"> The village economy changes from hunting to cultivation. Surplus production is stored and distributed from temples. Expansion of the urban environment, social stratification, technology, political nobility, large labour projects, commodity distribution, intercity and international exchange. Increase in population. Development of state-level societies. 	<ul style="list-style-type: none"> Technology: Writing developed in Sumerian temples and Mesopotamia to control resources. Wheel causes mobility of goods. 	<ul style="list-style-type: none"> Sumerian tokens used to keep daily records of agricultural resources. Mesopotamian tablets used for receipts, disbursements, partnership formations and dissolutions, inventories leases, purchases, sales, rentals and loans.
1900 B.C. – 1400 B.C.	Public Economy: Palaces	<ul style="list-style-type: none"> Build palaces in Crete. 	<ul style="list-style-type: none"> Technology: Use tablets to keep records for palaces. 	<ul style="list-style-type: none"> Records of transactions, people, animals, commodities, food, implements and weapons are kept. Keep records of incoming and distribution of goods.
1400 B.C. – 700 B.C.	Public Economy: Greek Empire	<ul style="list-style-type: none"> Colonisation takes place over the Mediterranean. Intellectual development makes progress with Greek philosophy and mathematics and literature. Wealth in temples is under control of the state. The state wants to secure imports of materials and commodities and tax collections. Achieve control over assets: <ul style="list-style-type: none"> ✓ Control stabilises the state and 	<ul style="list-style-type: none"> Use Mesopotamian record keeping practices. Record keeping practices spread to Greece and Egypt. Increase in the sophistication of writing and mathematical skills is experienced. Technology: Paper and written documents are developed. 	<ul style="list-style-type: none"> Parthenon as an example: Accountants report annually to the state. Financial statements are drafted, indicating income from rentals, interest on loans and expenditure for sacrifices, wages and entertainments. The state appoints Clerks and Treasurer of Public Revenue.

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
700 B.C. – 1000 A.D.	Feudal System	<p>the economy.</p> <ul style="list-style-type: none"> • Socio political: <ul style="list-style-type: none"> ✓ Expand to neighbouring states and master sea-routes. • Economy: <ul style="list-style-type: none"> ✓ Import metals, food and raw materials. ✓ The dominant state ownership economy moves to a feudal system. ✓ Discover money as form of wealth. ✓ Money as economic commodity results in a growth in peasant enterprises. 	<ul style="list-style-type: none"> • Develop legislation to ensure honest dealings. • New profession immerge: Banking-system. • Moveable wealth results in private initiatives – partnerships and companies. • Capitulare de Villis 812: Steward on Emperor's estate reports annually on the inventory of land, income and expenses. • In England: Domesday Book, Pipe Roll and Exchequer provide royal control over revenue and property. • Byzantine accounting practices advanced and well established. 	<ul style="list-style-type: none"> • Expansion of administration develops to keep track of resources and taxes. • Corporate governance develops – publish accounts of financial administration. • Daily entries of receipts and disbursements entered in daybook. • Exchequer uses charge and discharge accounting system. • The state uses financial information for planning and budgeting.
1000 – 1760	Commercial Capitalism	Lack of organised capital markets. Inadequacy of charge and discharge accounting system		
1000 - 1500	Exchange economy.	<ul style="list-style-type: none"> • Economic developments: <ul style="list-style-type: none"> ✓ Inter-regional trade. ✓ Interaction between investors and business operators. ✓ Provision of credit. ✓ Move wealth according to opportunities available. ✓ Florence, enormous growth in commerce experienced. • Business / reporting requirements: <ul style="list-style-type: none"> ✓ Need arises for useful business information: Planning of 	<ul style="list-style-type: none"> • Main commerce centres are: Genoa and Venice trade with Near East. • Capital owners should keep track of investments. • Investors need record of trading to apportion profits, need bookkeeping system. • The development of the Atlantic shipping route causes the financial innovation move to Bruges. 	<ul style="list-style-type: none"> • Genoa 1340: Donado Soranzo and Brothers use the double-entry system. • The profit and loss account and capital accounts are developed. • "Method of Venice" publication in 1458: Benedetto Cortrugili – Della Mercatura e del Mircanti Perfecto Della Mercautra. • The first academic publication

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		<ul style="list-style-type: none"> investments” major objective. ✓ Joint ventures and partnerships contracts are used: Need information on sharing of profits and losses and dissolution agreement. • Technological developments: <ul style="list-style-type: none"> ✓ Use of Arabic numeric system. ✓ Art of writing becomes more common. ✓ The invention of printing technology. 	<ul style="list-style-type: none"> • A wider acceptance of the double-entry system is detected. 	<ul style="list-style-type: none"> on accounting is made in 1494: Luca Pacioli – Summa de Arithmetica, Geometrica, Proportioni et Proportionalita. Principles for double entry bookkeeping system. • Pacioli: The purpose of bookkeeping is to give the trader information as to his assets and liabilities without delay. Information should be useful for decision-making.
1501 - 1760	Entrepreneur and Continuity	Need for long-term financing	Concept of Capital	
		<ul style="list-style-type: none"> • Economic developments: <ul style="list-style-type: none"> ✓ The entrepreneur manages a business with resources exceeding his personal capacity. ✓ Need experienced to finance business ventures. ✓ Use of Atlantic shipping routes, requires finances. ✓ Trading of money and bills between merchants, bankers and entrepreneurs starts. ✓ The VOC issues shares to raise finance from the general public. • Political developments: <ul style="list-style-type: none"> ✓ Wars in France, Germany and Britain – Governments cannot grand security for loans and bonds. • Business / reporting requirements: <ul style="list-style-type: none"> ✓ Stewardship questions regarding assets, liabilities and 	<ul style="list-style-type: none"> • Continuity as formulated in the capital model of Hugh Oldcastle. • Revenues and expenses are not regarded as important. • The banking industry develops and example is De Wisselbank van Amsterdam. • Active securities markets develop: <ul style="list-style-type: none"> ✓ Starting with Bruges Bourse in the Place de La Bourse ✓ Amsterdam 1620 - 65 000 investors. ✓ Amsterdam 1688 – spot and future contracts, call, put and straddle options, margin trading, hedging, short selling, defer payment and delivery. 	<ul style="list-style-type: none"> • Other influential authors: <ul style="list-style-type: none"> ✓ 1534 Jan Ympyn, describes the trial balance. He transfers the nominal accounts to a profit-and-loss account. Closes P&L account off to capital account. ✓ 1543 Hugh Oldcastle, formulates the capital model “Capital = Assets minus Liabilities” • See a wider use of the double entry accounting system. • Prepare financial reports to inform owners and investors. • Transfer money between merchants through an accounting entry of debits and credits. • Capital represents continuity

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		equity. ✓ VOC officers must provide a balance sheet on the last day of June. ✓ Trading on the securities market stimulates the need for financial information to investors and potential investors. • Technological developments: ✓ Productive efficiency. ✓ Dutch shipbuilding.	<ul style="list-style-type: none"> • First economic bubbles occur: Mississippi Bubble and South Sea Bubble. 	in a business enterprise.
1760 - 1830	Industrial Capitalism	Demand for large amounts of capital	Increase in financial institutions	
		<ul style="list-style-type: none"> • Social developments: ✓ Better living and health conditions exist. ✓ Population grows. • Economic developments: ✓ Big corporations emerge in canal, manufacturing, steel, railway and coal industries. ✓ Statutory company is invented. ✓ Large companies are capital intensive. ✓ The number of large manufacturing companies increases. ✓ Large businesses have high costs of fixed assets. • Business / Reporting requirements: ✓ Capital becomes mobile. ✓ The demand to maintain capital increases. ✓ Owners are absent from businesses. ✓ Accountability of business 	<ul style="list-style-type: none"> • Number of banks increase – 1800, 80 banks in London, 800 in Britain. • The period experiences the official opening of Stock exchanges – London 1773, New York 1792. • Public accountants provide financial expertise. • Better financial reporting is required. 	<ul style="list-style-type: none"> • At the beginning of the period the charge and discharge accounting system is still used. ✓ Reporting of the system is limited as it does not show amount of capital invested and, ✓ The system does not provide profit and other performance information. • The double-entry system is widely used. • Cost management accounting develops. • The concept of depreciation becomes more important. • Capital protection is important. • Increase in quality of financial statements is noted. • Fundamental accounting

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		<p>managers increases.</p> <ul style="list-style-type: none"> ✓ Shareholders demand investigations into books. ✓ Demand for financial reporting. • Technological developments: <ul style="list-style-type: none"> ✓ Manufacturing techniques develop. ✓ Costing methods of manufactured products develops. ✓ Mining techniques develop. ✓ Use of large numbers of labourers in labour intensive industries. 		<p>concepts in use are:</p> <ul style="list-style-type: none"> ✓ Going concern, ✓ Accruals, ✓ Consistency, ✓ Prudence.
1830 – 1900	Return on capital invested	Industrial development	Increase in financial disclosure and adoption of some accounting principles	
		<ul style="list-style-type: none"> • Economic developments: <ul style="list-style-type: none"> ✓ General positive economic climate exists. ✓ The growth in railway industry stimulates the economy. ✓ An increase in the separation between management and ownership occur. ✓ Speculation in railway shares causes the Railway Mania in mid-1840. ✓ There is a demand for return on investment in the form of dividends. ✓ A Financial crisis occurs in 1866. • Business / Reporting requirements: <ul style="list-style-type: none"> ✓ Financial regulation in UK is a laissez-faire system. 	<ul style="list-style-type: none"> • Financial reporting develops on demand of investors. • The importance of the reliability and accuracy of financial reports increases. • The disclosure levels of financial reporting in the railway industry increases after the Railway Mania. • The Royal Commission on Railways requests the standardisation of accounts. The result is the “Regulation of Railways Act 1868”. • The U.S. accounting profession is established in 1886 with the American Association of Public Accountants. 	<ul style="list-style-type: none"> • Standardisation of depreciation treatment is developed. • Accounting moves from the cash to an accrual basis. • The accepted accounting practices at the end of this period (section 2.5): <ul style="list-style-type: none"> ✓ the adoption of the going concern concept; ✓ the historical cost concept was used to capitalise the cost of fixed assets; ✓ a move from cash to accrual basis of accounting; ✓ a selection of particular valuation procedures; ✓ the concept of prudence /

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		<ul style="list-style-type: none"> ✓ The general status on financial reporting is that it is unregulated with little statutory requirements. ✓ Minimum regulations are prescribed by the London Stock Exchange. ✓ The railway industry has long-term assets. Need exists to forecast on assets life. ✓ The Companies Act is promulgated in 1855. ✓ Management chooses accounting principles and practices to suit the goals of the organisation. ✓ Investors are exploited by manipulating accounting records. • Technological developments: <ul style="list-style-type: none"> ✓ The manufacturing industry and the development of the steam engine for railway industry boost technological developments. 		<ul style="list-style-type: none"> conservatism; ✓ the adoption of depreciation accounting in some entities; ✓ comparability and consistency of financial statements, and; ✓ the absence of general agreement on profit measurement and asset valuation procedures.
1901 – 1938	Corporate Capitalism and Verifiability	Corporate policy	Verifiability and standardisation of reporting	
		<ul style="list-style-type: none"> • Social / Political developments: <ul style="list-style-type: none"> ✓ World War I ✓ Availability of cash due to repayment of Liberty Bonds by the U.S. government stimulates stock market. • Economic developments: <ul style="list-style-type: none"> ✓ Increase in trading on stock exchanges. ✓ Financial disaster - 1929 Great 	<ul style="list-style-type: none"> • Establishment of professional accounting bodies. <ul style="list-style-type: none"> ✓ Professional accounting bodies take responsibility for accounting standards. • Implementation of standardisation process on accounting principles and 	<ul style="list-style-type: none"> • Proprietary theory dominant at turn of century, replaced with entity theory. • Publication of: <ul style="list-style-type: none"> ✓ A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements” by the AAA and, ✓ the “Statement of

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		Depression. ✓ Establishment of the Securities and Exchange Commission (SEC) in 1934. • Business / Reporting requirements: ✓ Regulation on financial reporting required. ✓ No uniformity in financial reporting. ✓ Shareholders demanded better information. ✓ Cooperation between AIA and New York Stock Exchange to draft accepted accounting principles. • Technological developments: ✓ Mass production of documents.	practices initiated. • Balance sheet is regarded as the most important financial report. • General Electric becomes trendsetter in financial report in 1931: ✓ General Electric publishes an audited financial report with comparative Statement of Income and Expenses, Balance Sheet and notes on some assets. • AIA reacts to government regulation by appointing a special committee to develop five accepted accounting principles. • Academic work starts on accounting theory to formulate postulates and principles for accounting. • Academic body, AAA is created to encourage academic thinking on accounting principles. ✓ Founding of academic journals for accounting.	accounting principles” published by Sanders, Hatfield and Moore.
1938 – 1973	Market failures and extension of Accounting Disclosure	Market failures, statutory pressure to regulate accounting	Professional bodies search for accounting principles	
		• Economic developments: ✓ Enormous growth in stock	• Professional bodies summarise accounting	• In 1957, the APB recommends a conceptual

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		<p>exchanges.</p> <ul style="list-style-type: none"> ✓ Pressure from the SEC in reaction to the 1929 depression to improve financial reporting. ✓ Corporate failures and stock market crashes. • Business / Reporting requirements: <ul style="list-style-type: none"> ✓ Financial reporting should be standardised. ✓ SEC requires guidance on specific problems in accounting practices. ✓ SEC approves accounting standards for the U.S. 	<p>practices without a theoretical basis.</p> <ul style="list-style-type: none"> • Ad hoc reactions from the professional accounting bodies on SEC requests. • Alternative accounting practices allowed. • The APB issue ARB's without a theoretical basis. • APB replaced due to lack of a framework for developing accounting principles. • In 1971, AICPA appoints: <ul style="list-style-type: none"> ✓ Wheat committee – should determine changes needed to get better and faster results. ✓ Trueblood Committee – objective to determine objectives of financial reporting. 	<p>approach for accounting on four levels: postulates, principles, rules and other guides and research.</p> <ul style="list-style-type: none"> • A lot of discussion during 1960 – 1973 on accounting postulates and principles, ARSs are published. • In 1966 the AAA publishes ASOBAT. • In 1970 the APB publishes Statement No. 4. • Wheat committee recommends restructuring and formation of FASB. • Trueblood Committee recommends decision-usefulness as objective for financial reporting. • See summary of historical document building up to the FASB conceptual framework (Table 2.1).
1973 to the present	Global Capital Markets	Global Capital Markets	Search for global acceptable financial accounting standards	
	<p>Conceptual frameworks published in the U.S.</p>	<ul style="list-style-type: none"> • Economic developments: <ul style="list-style-type: none"> ✓ Global corporations formed after World War II. ✓ Internationalisation of capital markets with listings in different countries. ✓ SEC requires reconciliation between U.S. GAAP and foreign accounting standards. • Business / Reporting requirements: 	<ul style="list-style-type: none"> • Formation of the FASB in 1973. <ul style="list-style-type: none"> ✓ FASB searches for single accounting theory to serve as basis for accounting standards. ✓ FASB published accounting standards. • AAA reconsiders accounting theory in 1977 – publishes 	<ul style="list-style-type: none"> • SATTA concludes that no single theory of accounting exists. • FASB starts a conceptual framework project. <ul style="list-style-type: none"> ✓ Publishes 8 SFAC's between 1978 and 2010. ✓ SFAC No. 5 rejected by accounting community. ✓ Lack of status of the

Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		<ul style="list-style-type: none"> ✓ Need for global standardisation of financial reporting. 	SATTA. <ul style="list-style-type: none"> • Historical cost as measurement criteria causes problems in SFAC No. 5. • Acceptance of accounting standards based on a sound theory hindered by: <ul style="list-style-type: none"> ✓ Pressure and acceptance requirements from SEC, ✓ Non-agreement on principles by accountants. 	SFAC has to influence the revision and setting of standards contributes to a negative evaluation of the project. <ul style="list-style-type: none"> ✓ SFAC No. 10 is a joint effort between the FASB and the IASB.
	CFfFR in Europe	<ul style="list-style-type: none"> • Growth in MNE's experienced in Europe. • Need arises to harmonise vastly different accounting standards across countries. • New York Stock Exchange accepts listing under IFRS before SEC approves it. • Technology developments: <ul style="list-style-type: none"> ✓ Computer technologies such as mainframes, desktop computers and laptops. ✓ Internet and World Wide Web. 	<ul style="list-style-type: none"> • Formation of IASC followed up by the IASB in Europe. • IASC criticised because it drafts IAS's without a conceptual framework as basis. • XBRL project • Numerous software packages to capture and manage accounting data. • Business to business transactions over the internet. 	<ul style="list-style-type: none"> • IASC publishes IASs • IAS 1 published in 1995. • Start a framework project in 1984 following a "fill the gap" approach that evolves into a "building block" approach. • IASC publish a conceptual framework based on FASB SFAC's in 1989.
2002 - 2010	Joint FASB and IASB conceptual framework.	<ul style="list-style-type: none"> • SEC supports convergence of accounting standards. • SEC accepts reporting under IFRS without reconciliation with U.S. GAAP. • Need for principles-based accounting standards rooted in fundamental concepts expressed by 	<ul style="list-style-type: none"> • European Union decides in 2002 to use IFRSs from 1 January 2005. • Norwalk Agreement between FASB and IASB in 2002 encourages joint projects between the FASB and IASB. 	<ul style="list-style-type: none"> • The first stage of the joint conceptual framework, "The Conceptual Framework for Financial Reporting" is published on 28 September 2010.

Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8	Ch 9	Ch 10
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Date	Period	Stimulus	Response	Contribution to accounting and CFfFR
		FASB and IASB.	✓ Joint project adopted to develop a globally acceptable conceptual framework and remove individual differences between U.S. GAAP and IFRS's.	

(This summary was done by the author)

In summary, the need for a conceptual framework for accounting to guide accounting standard setters in setting inherently consistent accounting standards existed from the early stages of the twentieth century. The search for acceptable accounting postulates started in 1922 with the publication of W.A. Paton “*Accounting Theory*” and reached a certain degree of maturity and acceptance by the accounting community with the publication of the IASC CFfFR document in 1989. However, in practice other factors like general practices, acceptance by law enforcement bodies for example the SEC, cultural and personal preferences and not necessarily being linked to a consistent theoretical basis are sometimes given preference over a more theoretically sound document like the CFfFR.

Although the IASB is currently revising the CFfFR, there is no guarantee that the revised CFfFR will be internally consistent and internationally converged as envisaged by the IASB (2010a). The purpose of this study is to investigate how to build an ontology of the CFfFR in a formal language that can contribute towards formulating a global CFfFR that is internally coherent, logically consistent and unambiguous.

2.10 A Global CFfFR: A Wicket Problem

From the literature review in Chapter 2, it is argued that there is a need for a globally acceptable CFfFR in the accounting community. During the discussion in Chapter 2 it is indicated how it happened that the CFfFR is not globally accepted. The various stimuli for developments in accounting and financial reporting can be summarised under the following classes: political developments, social developments, economic developments, business / reporting requirements, and technological developments (Table 2.3). It is indicated in Table 2.3 how some of the responses on the stimuli contributed to the postulates and principles of financial reporting, and were included in the CFfFR. The fact that, after decades of dedication, there is not one global CFfFR is an indication that the creation of a global CFfFR is complex process involving influences, factors and reasons of diverse nature (Chapter 4).

An appropriate and well-established research strategy, Design Science Research (DSR), is used in Information Systems (IS)⁴⁷ for research projects that can be described as wicked problems (Hevner et al., 2004; Hevner & Chatterjee, 2010). Wicked problems in IS are characterised by:

- “unstable requirements and constraints based upon ill-defined environmental contexts
- complex interactions among subcomponents of the problem and its solution
- inherent flexibility to change design processes as well as design artefacts (i.e., malleable processes and artefacts)
- a critical dependence upon human cognitive abilities (e.g., creativity) to produce effective solutions

⁴⁷ IS instead of computing is used here as that is the term used by Vaishnavi and Keuchler (2013) and Hevner et al. (2004) in relationship to DSR.

- a critical dependence upon human social abilities (e.g. teamwork) to produce effective solutions” (Hevner et al., 2004:81).

The research problems answered in this study comply with the characteristics of wicked problems. The *requirements* of a global CFfFR are not clearly defined by either the FASB or the IASB. During interaction with the IASB it was discovered that a formal definition for a global CFfFR does not exist. Secondly, there are many *complex interactions* among subcomponents of the problem on how to develop a global CFfFR. These interactions are discussed in Chapter 4, when the requirements of a global CFfFR are identified. The process to design an artefact (CFfFR ontology) is *flexible* and consists of several iterations to change the design process. The DSR design of the CFfFR ontology depends upon the *cognitive abilities* (domain knowledge) of the researcher, consulting with an ontology engineer to produce an effective solution. The project was *critically dependent* on the teamwork between an ontology engineer and a domain specialist.

The wicked research problem identified is how the use of ontology technologies can contribute towards the improvement of the CFfFR by designing a CFfFR ontology. The DSR process of designing the CFfFR ontology contributes towards solving the wicked research problem of creating a global CFfFR by indicating internal incoherencies, logical inconsistencies, unintended meanings and incompletenesses in the CFfFR when the CFfFR is compared to the ideal CFfFR.

It could be concluded that historical development of the CFfFR can be described as an uncompleted evolutionary process (Camfferman & Zeff, 2009; Riahi-Belkaoui, 2004; Stamp, 1980; Stamp, 1970). This study attempts to contribute towards the evolutionary process of improving the CFfFR.

2.11 Conclusion

The purpose of the literature review was to determine, looking through a system of stimuli / response, how the CFfFR evolved and identify the research gap. Chapter 2 starts with the first traces of accounting in the Sumerian temples during the pre-capitalist period (4000 B.C. – 1000 A.D.) (Section 2.2). The objective of accounting in a public economy (4000 B.C. – 700 B.C.) was to control state assets (section 2.2.1). The sophistication of the accounting systems used in the Greek Dynasty and Roman Empires were discussed under the Feudal System (700 B.C. – 1000 A.D.) (section 2.2.2). During this period (700 B.C. – 1000 A.D.), money as moveable wealth was discovered, the banking system developed, the first steps were taken towards corporate governance, and private ownership were introduced.

The period 1000 A.D. – 1760 was labelled as the period of commercial capitalism (section 2.3). With money as moveable wealth the exchange economy (1000 A.D. - 1500) flourished. Medieval trading, with Venice and Genoa as centres, developed and business saw the introduction of partnerships (sections 2.3.1a) and 2.3.1b)). During this period one of the most basic fundamentals of modern day accounting was developed. The principles of the double entry accounting system (the Method of Venice section 2.3.1c)) was published in the *Summa de Arithmetica, Geometrica*,

Proportioni et Proportionalita in 1494 by Luca Pacioli. The stimulus for the development of the double entry accounting system was the demand for useful financial information (section 2.3.1d)). Another important technological development for the purpose of accounting was the acceptance of the Arabic numeric system (section 2.3.1e)).

During the period 1500 to 1760, the entrepreneur emerged (Salvary, 1979). The accounting equation (section 2.3.2a)) introducing the concept of capital and the maintenance of capital, was developed by Hugh Oldcastle in 1543. In the same year 1543, Ympyn is credited with the development of the trail balance (section 2.3.2b)). The economic development in Europe during the seventeenth century is marked as the last phase of transition from a feudal to a capitalist economy and is seen as the period of transition to capitalism (Wallerstein, 1980) with active securities markets in Europe and America by the end of the seventeenth century. The founding of *De Wisselbank van Amsterdam* in 1609 marked the beginning of bank transfers of money between merchants through debits and credits (section 2.3.2d)). A boom in the shipbuilding industry stimulated a need to productive and efficient manufacturing practices (section 2.3.2e)).

During the industrial capitalism period (1760-1830) (section 2.4), known as the period of the Industrial Revolution, the demands for capital and capital maintenance (section 2.4.1), better accountability (section 2.4.2), and financial reports (section 2.4.3) caused the general acceptance of the double-entry system already documented by Pacioli in 1494.

From 1830-1900, labelled as financial capitalism: the return on capital invested period (section 2.5), financial reporting was unregulated with demands for regulation starting after the Railway Mania (section 2.5.1c)) in the 1840's. It took financial crises to put demands for financial reporting regulation into legal action. The Royal Commission on Railways in the UK requested a standardised system of accounts in 1866. As a result, the "Regulation of Railways Act 1868 contained fifteen financial and statistical statements designed to improve comparability" (Edwards, 1996:65) and provided shareholders with information to assess the financial position of a company (section 2.5.2d)). The response was the emergence of fundamental accounting concepts and the increase in financial disclosure (sections 2.5.2e) and 2.5.2f)).

During the period 1901-1938 (section 2.6), financial reporting developed from unregulated to a regulated industry that improved beyond legislation (sections 2.6.1a) and 2.6.1c)), mainly in reaction to the stock market crash of 1929 and the Great Depression (section 2.6.1b)). The regulation of financial reporting developed simultaneously with the development of the accounting profession (sections 2.6.2a), 2.6.2b)). It also introduced the first steps towards the academic search of an accounting theory (section 2.6.2c)).

The search for accounting postulates and principles were continued during 1938-1973 with the formation of professional bodies reacting to pressure from the SEC (sections 2.7.1 and 2.7.2). The globalisation of capital markets after World War II

stimulated and increased the intensity to produce one set of global accounting standards. The formation of the FASB resulting from a recommendation by the Wheat Committee (section 2.7.2a)) introduced a new era in standard setting (section 2.7.2).

Since 1973, with the development of computer technologies and the introduction of the World Wide Web, global companies trading across continents became the norm rather than the exception. The need for global accounting standards demanded an internally coherent and consistent framework that could serve as basis to develop accounting standards. The FASB reacted to the demand and produced SFAC's that could serve as a conceptual framework for financial reporting (section 2.8.1). In Europe, global capitalisation was the main stimulus to develop one set of high quality accounting standards. The IASC was formed in 1973 with the purpose to produce such a set of standards (section 2.8.2). Initially the IASC developed its standards without a conceptual framework. In order to obtain legitimacy for its standards, the IASC adopted and adjusted the FASB's SFAC's, with inputs from frameworks from other standard setting bodies, and published the "*Framework for the Preparation and Presentation of Financial Statements*" as a single document in 1989 (IASB, 1989).

With both the IASB and the FASB closely related, but not identical frameworks, the search for a single globally acceptable conceptual framework officially started on 18 September 2002 with "*The Norwalk Agreement*" (FASB and IASB, 2002) (section 2.8.3b)). On 28 September 2010 the first product of the joint conceptual framework project was published with chapters 1 and 3 of the Conceptual Framework for Financial Reporting (CfFR) being the fruit of the joint project between the FASB and the IASB (IASB, 2010a) (section 2.8.3c).

Since the publication of the CfFR, the joint project between the IASB and the FASB to develop one global CfFR was stopped leaving a wicket problem to be solved (section 2.10). This study contributes towards answering the wicket problem by attempting to indicate how the use of ontology technologies could contribute towards the improvement of the CfFR by designing a CfFR ontology.

SECTION B – RESEARCH DESIGN

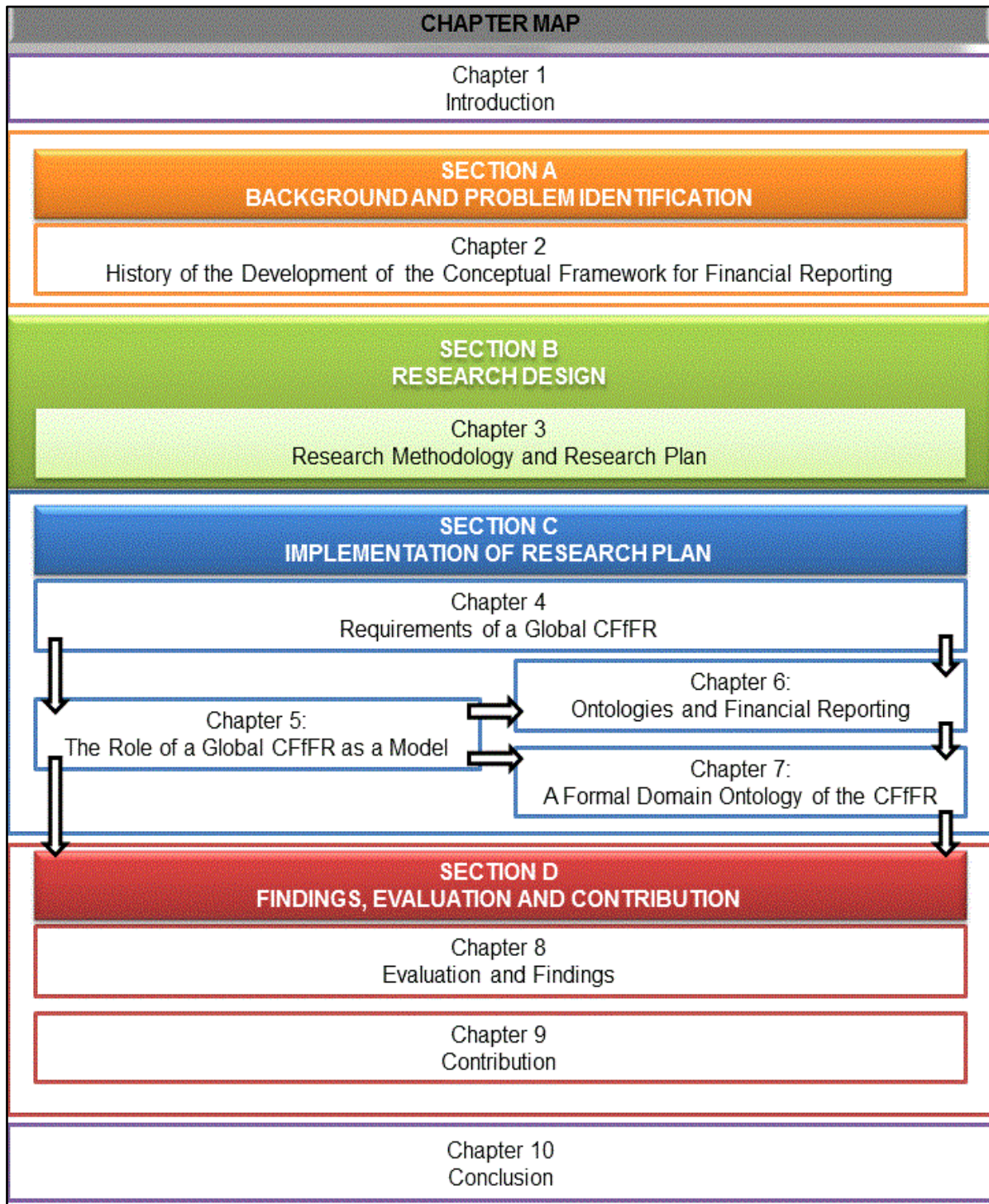


Figure 2.4: Chapter map - Section B, Chapter 3

CHAPTER 3

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3 RESEARCH METHODOLOGY AND RESEARCH PLAN

3.1 Introduction

Section A that consists of Chapter 2 provides the background on the historical development of the Conceptual Framework for Financial Reporting published by the IASB (the CFfFR), as well as the research problem, (section 2.10, a global CFfFR: A wicket problem) addressed by this study.

This is a qualitative multi-disciplinary study, involving mainly accounting and computing, but also touching on philosophy and the philosophy of science. Various research techniques and procedures are utilised to address the research problem proposed in section 2.10. Chapter 3 provides an overview of the research design of this study.

The research design adopted in this study is mainly based on the “research onion” concept of Saunders et al. (2012). The research onion consists of (1) philosophy: the ontological view of reality (positivism, realism, interpretivism and pragmatism), (2) the research approach or epistemology (deduction, induction and abduction), (3) methodological choice, (4) research strategy, (5) time horizon of the study and (6) the specific techniques and procedures of research. It can be graphically illustrated as depicted in Figure 3.1.

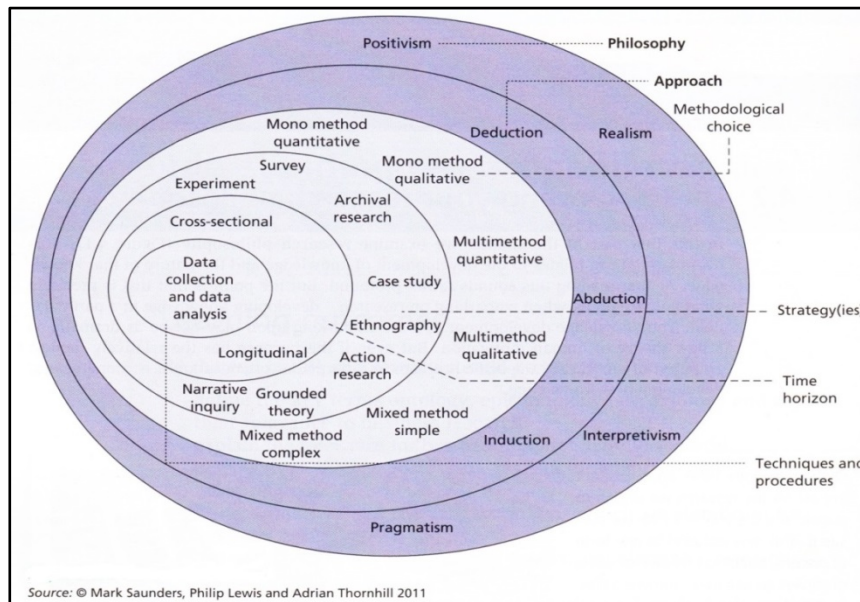


Figure 3.1: The research “onion”

With the research onion of Saunders et al. (2012) as basis, the following research plan was followed in this study to address the research problem identified in section 2.10.

- The research questions formulated to address the research problem are revisited in section 3.2.
- The philosophy i.e. the ontological view of reality adopted in the study as well as the axiological implications of the ontological view is provided in section 3.3.

- The choice of research approaches followed in this study are motivated in section 3.4.
- The methodological choice is discussed in section 3.5.
- The research strategy is explained in section 3.6.
- The time horizon of the study is given in section 3.7.
- The last step of the research plan, the research techniques and procedures used, is provided in section 3.8.

In section 3.9, the verification of the research results are explained and section 3.10 provides the limitations and boundaries of the study.

3.2 Research Problem and Research Questions

Since the Great Depression of 1929 to 1933, the accounting community have been searching for a globally acceptable conceptual framework that could provide fundamental concepts to form a sound foundation for the development of accounting standards that are principally based, internally consistent and internationally converged (Bullen & Crook, 2005). In section 2.10, the research problem was identified as follows: how can the use of ontology technologies contribute towards the improvement of the CFfFR by designing a CFfFR ontology. Based on the research problem the main research question is posed.

The **main research question (MRQ)**: How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

The following sub-research questions are posed to solve the main research question:

- **Sub-research Question 1 (SRQ 1):**
What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research Question 2 (SRQ 2):**
How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research Question 3 (SRQ 3):**
How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

In this study the CFfFR is used as a model to test the role and requirements of a globally acceptable conceptual framework for financial reporting (global CFfFR).

Based on the research onion of Saunders et al. (2012) as provided in Figure 3.1, the first step in research design is to determine the ontological view of reality adopted in a study. The ontological view of reality is discussed in section 3.3.

3.3 Philosophy: Ontological View of Reality and Axiological Implication

From a philosophical perspective ontology is concerned with the nature of reality (Saunders et al., 2012), also described as “the theory of being” (Gaffikin, 2008:6). Based on the ontological commitment a research project makes assumptions on what exists and what does not or cannot exist (Gaffikin, 2008). Saunders et al. (2012) provides a summary of research philosophies and approaches in what they call the “research onion” (Figure 3.1). The philosophical assumption of reality or ontology adopted by a researcher determines the research approach followed in a particular study. The four popular research philosophies used to conduct research are pragmatism, positivism, realism and interpretivism.⁴⁸ The four philosophical ontological views of reality are discussed in sections 3.3.1 to 3.3.4. The ontological view adopted in this study is stated and motivated in section 3.3.4. The research philosophy adopted is linked to the values of a researcher.

Axiology is the study of the role values play in the research process. The different research philosophies of reality have different axiological implications. The axiological implication of the adopted research philosophy on the research process is discussed in section 3.3.5.

3.3.1 Pragmatism

According to pragmatism, the most important determinant is the research question. If the research question does not without a doubt point towards a particular philosophy, a pragmatist’s view is that it is possible to work with different philosophical positions. The implication is that multiple methods are possible and possibly highly appropriate within one study (Saunders et al., 2012). It would be possible for this study to adopt a pragmatist’s view as multiple methods are used to answer the different research questions. However, in this study the nature of the reality under investigation and not the research questions determines the philosophical perspective of reality.

3.3.2 Positivism

Positivism is traditionally associated with the natural sciences. As far as possible, research is undertaken in a value-free way and knowledge is objectively determined (Gaffikin, 2008; Saunders et al., 2012). According to a positivist view, reality is external to the researcher (Gaffikin, 2008). The researcher has an objective stance towards reality and is independent of the research object (Gaffikin, 2008). Traditionally a researcher with a positivist view of reality would develop a hypothesis

⁴⁸ Myers (2013) discuss the positivist, interpretive and critical perspectives. Riahi-Belkaoui (2004) distinguishes between four different views for accounting research: the functionalist view, the interpretive view, the radical humanist view, and the radical structuralist view.

regarding the research object and then collect data in an objective manner to either prove or falsify the hypothesis (Deegan, 2014).

This study does not adopt a positivist view of reality. Data is not collected objectively in a value-free way to test a specific hypothesis or theory. It is conceded that the building of a formal ontology of the CFfFR can be done adopting a positivist view of reality. The argument would be that the CFfFR is an objective social reality and the method used to build the formal ontology involves an objective process of applying rules using a logical, mathematically proven and technically advanced computer program. In this study it is assumed that the researcher is subjectively involved when making modeling decisions rather than applying a rule objectively during the decision making process.

3.3.3 Realism

Realism, according to Ryan et al. (2002:13), represents “the common-sense view that, when we describe something, that thing has a reality which is independent of our perception of it”. The philosophy of realism assumes that objects in the world is a reality independent of the mind and exists independently of the us (Saunders et al., 2012; Gaffikin, 2008). Realism is similar to positivism regarding data collection “in that it assumes a scientific approach to the development of knowledge” (Saunders et al., 2012:136). Two forms of realism, direct realism and critical realism are identified.

According to direct realism, what you see is what you get and the world is portrayed accurately through our senses. According to a critical realism perspective reality “exists independently of human thoughts and beliefs or knowledge of their existence, but is interpreted through social conditioning” (Saunders et al., 2012:140). As with positivism, this study can arguably be done from a realism perspective. The same objections can however be raised against realism than what was raised against positivism. The researcher’s involvement in making modeling decisions suggests a more subjective involvement in the research process than allowed by realism. The ontological perspective adopted in this study is close to critical realism. The model theory of Mäki (2008) utilised in Chapter 5 can be viewed from a critical realism perspective.

3.3.4 Interpretivism

Interpretivism adopts a more subjective view of reality *i.e.* “that social phenomena are created from the perceptions and consequent actions of social actors” (Saunders et al., 2012:132). According to a non-realist ontology⁴⁹ (Gaffikin, 2008) the world is socially constructed and can only be understood in terms of how people describe it.

Social reality is constantly changing and in a state of revision as it is being constructed. Researchers may interpret a social reality differently in consequence of their own view and experience of reality. It is the role of the researcher to understand

⁴⁹ Gaffikin (2008) uses non-realist ontology to describe what Saunders et al. (2012) classifies as interpretivism.

the subjective reality of the social phenomena under investigation. The subjective reality to be understood includes the motives, actions and intentions that are meaningful to a specific social phenomena (Saunders et al., 2012).

3.3.5 Philosophy Used in This Study

An interpretivist ontological and epistemological view is adopted in this study with respect to a view on social realities as being socially constructed, subjective and may therefore change (Saunders et al., 2012). The conventional test for an interpretivist view is whether an object still exists if one takes away the human mind. If an object does not exist when the human mind is taken away, it is a social construct and is mind-dependent (Saunders et al., 2012)⁵⁰

Based on the history of the development of the CFfFR (Chapter 2), it may be argued that accounting as phenomenon, financial accounting standards and the CFfFR is the result of human involvement, thoughts and activities. The underlying reality of accounting is economic activities that constitute social activities. This is in agreement with Ryan et al. (2002:9) who stated that “research in accounting and finance is generally accepted as being social scientific”. The nature or ontology of the reality under investigation, the CFfFR, is a social construct and can be classified as a social entity.

For the purpose of this study the ontological assumption adopted is that the CFfFR as a social phenomenon is created from the perceptions and actions (Saunders et al., 2012) of the accounting community – the IASB. The CFfFR is a social construct, created by a social organisation (IASB) with input from the accounting community, written in natural language. It can be concluded that the CFfFR as a social reality “is variously shaped by, and dependent on people’s beliefs and expectation, goals and wants, plans and impulses, emotions and reasonings” (Mäki, 2008:339).

One of the characteristics of social phenomena is that they are in a constant state of revision (Saunders et al., 2012). The history of the development of the CFfFR (Chapter 2) clearly indicates how the CFfFR evolved over time, and is constantly revised by humans (Gaffikin, 2008). The IASB as the body responsible to draft and revise the CFfFR also serves as a representative of the community within which the perceptions and actions regarding the CFfFR are formed. Based on the nature and characteristics of the CFfFR, an interpretivist ontological view of the nature of the CFfFR is adopted. From the perspective of the ontologist, the interpretivist view is in agreement with Wolterstorff (1970:Xiii) that the ontologist description of reality is “invariably shaped and formed by many factors – cultural, linguistic, religious, and more.” The interpretivist assumption adopted in this study agrees with the research perspective for DSR as described by Vaishnavi and Keuchler (2013:Table 3).

⁵⁰ This study does not adopt the extreme non-realist world view of the solipsist as described by Gaffikin (2008).

Axiological Implication

The axiological implication of an interpretivist ontological view is that “the researcher is part of what is being researched and cannot be separated and so will be subjective” (Saunders et al., 2012:140). This study is in agreement with Ryan et al. (2002:20) who stated that an “explanation in the social sciences invariably entails interpretation”. The interpretation has a subjective element to it, as the researcher forms part of the thought process of other researchers to formulate and create a new social reality – a formal ontology of the CFfFR. The subjective involvement of the researcher in the modeling process has already been established in the discussion of positivism and realism above.

The approach to a research project is linked to the researchers’ ontological view of reality adopted for the study. In section 3.4 different research approaches and how they are applied in this study, are discussed.

3.4 Research Approaches

According to Saunders et al (2012) research can be approached from basically two perspectives, an inductive approach or a deductive approach with a combination of the two known as an abductive approach. These approaches are based on the reasoning direction adopted in a research project. The epistemology to do research on the CFfFR from an interpretivist philosophical stance is inclined to be subjective and qualitative in nature.

3.4.1 Deductive

Deductive reasoning is used when logical conclusions are made from a set of premises and the conclusion is true if all the premises are true (Deegan, 2014). Deductive reasoning is the dominant research approach in the natural sciences (Saunders et al., 2012). A deductive approach generalises from the general to the specific and uses data to evaluate propositions or hypotheses related to a theory (Deegan, 2014; Saunders et al., 2012). Deductive reasoning involves the development of theory and then subject the theory to rigorous testing. The verification or falsification of the tested theory is the aim of a deductive study. This study utilises deductive reasoning in answering some of the research questions.

3.4.2 Inductive

An inductive approach is used when a theory is formulated by collecting data and analysing it and is traditionally associated with positivism (Gaffikin, 2008). The theory is “often expressed as a conceptual framework” (Saunders et al., 2012:146). In an inductive approach, a study generalises from the specific to the general. Instances of a phenomenon are studied and by way of induction a conclusion or theory is derived based on the study (Gaffikin, 2008).

Data collection is used to explore a phenomenon, themes and patterns are identified and a theory or conceptual framework is constructed based on the identified themes and patterns (Saunders et al., 2012). Theory building and generation is the result of

an inductive study. In accounting an inductive study usually makes use of the tools of statistics to draw a conclusion (Gaffikin, 2008). Although an inductive approach was used to answer some of the research questions by building a theory regarding the value of the use of models in building the formal domain ontology of the CFfFR, no statistical tools were used in the process.

3.4.3 Abductive

An abductive approach moves back and forth between inductive and deductive approaches, thus combining induction and deduction approaches. According to Saunders et al. (2012) many business and management researchers use an abductive approach. According to Saunders et al. (2012:147) “abduction begins with the observation of a ‘surprising fact’; it then works out a plausible theory of how this could have occurred”. In an abductive approach, known premises are used to generate testable conclusions and interaction between the specific and the general is used to generalise. According to Saunders et al. (2012:144) in an abductive approach “data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth.

3.4.4 Research Approaches Used in This Study

According to Myers (2013:23) “both inductive and deductive reasoning can be used in qualitative research”. In this study, both inductive and deductive reasoning approaches were used to answer the respective sub-research questions. The main research question was answered using an abductive approach.

The phenomenon and development of the CFfFR were explored in the literature review in Chapter 2 using an inductive approach. An inductive approach was also used in Chapter 4 to answer the first sub-research question (SRQ 1)⁵¹ (section 3.2). SRQ 1 was answered by investigating the literature on the CFfFR, documents published in the run-up to the development of the CFfFR, and the CFfFR itself to identify the definition and requirements of a global CFfFR from the documents investigated. The results of Chapter 4 are refined in Chapter 5 by determining the role of a global CFfFR using a different research technique (section 3.8.2).

The second sub-research question (SRQ 2)⁵² was answered using a deductive approach. Chapter 5 focuses on the second sub-research question and uses modeling theories from philosophy of science and Computing to refine and expand on the results of Chapter 4. A deductive approach was followed by applying model building theories and methodologies in Chapter 5 to the CFfFR to answer SRQ 2. The modeling theories used, serve as the set of premises against which the CFfFR is

⁵¹ **SRQ 1:** What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principal-based, internally consistent and internationally converged?

⁵² **SRQ 2:** How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principal-based, internally consistent and internationally converged?

tested. After the characteristics of the CFfFR were compared against the modeling characteristics obtained from the modeling theories a conclusion was made regarding the role of a global CFfFR.

The third sub-research question (SRQ 3)⁵³ was answered using a deductive approach. SRQ 3 was answered in Chapter 6. Chapter 6 builds on the modeling theories of Chapter 5. The applicability of theories regarding ontologies, from both philosophical and computing perspectives was used and the applicability and value of the use of ontologies on the CFfFR were demonstrated in Chapter 6. Based on the applicability of the theories on the CFfFR it was concluded that ontologies could assist to construct a CFfFR consisting of logically formalised fundamental concepts.

The main research question (MRQ)⁵⁴ was answered by building a formal domain ontology of the CFfFR. The building process went through four iterations and is reported on in Chapter 7. The building of the formal ontology of the CFfFR (see Chapter 7) follows mainly an abductive approach⁵⁵ as it involves an analysis of the natural text (observation or data collection). Plausible theories regarding a decision process to report decision-useful information were identified (Figure 7.19) and a model regarding competency questions, classes and relationships to be included in the CFfFR ontology were constructed (Figure 7.21). Based on these premises testable conclusions were made identifying inconsistencies and unintended meanings during the formalisation process by making modeling decisions and testing the modeling decisions. Incomplete aspects and implied domain knowledge were also reported on during the modeling process.

Existing theories from different disciplines were adopted, adapted, used and incorporated to build and test the theory that a formal domain ontology of the CFfFR could assist in creating a global CFfFR. By building the formal domain ontology of the CFfFR the main research question is answered using an abductive approach.

Finally, if the formal domain ontology of the CFfFR adheres to more of the requirements and role of an idealised CFfFR than the CFfFR itself, the main research question is answered. The formal domain ontology of the CFfFR does adhere to more of the requirements and role of a possible global CFfFR than the CFfFR.

In section 3.5, the next layer of the research onion *i.e.* the methodological choice is discussed.

⁵³ **SRQ 3:** How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principal-based, internally consistent and internationally converged?

⁵⁴ **MRQ:** How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principal-based, internally consistent and internationally converged?

⁵⁵ The abductive and deductive approaches in building the CFfFR ontology artefact are in agreement with the cognitive processes during a DSR project as explained by Vaishnavi and Kuechler (2013:Figure 4).

3.5 Methodological Choice

The methodological choice of a research project involves the choice between quantitative and qualitative methods of data collection and data analysis (Saunders et al., 2012). Quantitative methods are concerned with numeric data while qualitative methods use non-numeric data such as words, images, video clips and similar material (Saunders et al., 2012). This study is a qualitative study utilising different qualitative methods to answer the different research questions. The specific data collection techniques and procedures to collect and analyse data are discussed in section 3.8.

The approach in this study towards choosing a research methodology is to select the method best suited to answer a specific research question. The research design in this study is to use multiple qualitative research methods in order to achieve the stated research objective. The use of multiple qualitative research methods is supported by Myers (2013) and Ryan et al. (2002). This study is in agreement with Ryan et al. (2002:30) who states that “we believe that a plurality of methodologies is possible and each can lead to fruitful research”. This study can be described as a multi-method qualitative study⁵⁶ as it is restricted to qualitative methods of data collection and data analysis only (Saunders et al., 2012).

The multi-method qualitative study was performed adopting a research strategy utilised in the Computing discipline known as Design Science Research (DSR).

3.6 Research Strategy

The research strategy entails the plan of action to achieve the research objective. Research strategies that are traditionally associated with a qualitative research project are: “...action research, case study research, ethnography, Grounded Theory and narrative research” (Saunders et al., 2012:163). However, the overall research strategy of this study does not fit one of the more commonly used research strategies as mentioned in Saunders et al. (2012). The nature of the study was more cyclic with one cycle building on the results of a previous cycle and answering new questions that resulted from the previous cycle.

An appropriate and well-established research strategy, Design Science Research (DSR) is used in Information Systems (IS) (March & Storey, 2008; Peffers, Tuunanen, Rothenberger, Marcus, & Chatterjee, 2007).⁵⁷ DSR “is distinguished from routine design by the *production of interesting (to a community) new knowledge*” (Vaishnavi & Kuechler, 2013:6). DSR efforts typically target the “we don’t know how to do this yet” areas of design distinguishing DSR from routine design by the intellectual risk and number of unknowns in a proposed design (Vaishnavi & Kuechler, 2013; Kuechler & Vaishnavi, 2008).

⁵⁶ Mixed methods of research combines qualitative and quantitative methods of data collection and data analysis in one study.

⁵⁷ IS instead of computing is used here as that is the term used by Vaishnavi and Keuchler (2013) and Hevner et al. (2004) in relation to DSR.

The complexity and intellectual risk attached to DSR projects gave rise to the description of DSR research problems to be typified as wicked problems (Hevner et al., 2004; Hevner & Chatterjee, 2010). Wicked problems are characterised by unstable requirements with complex interactions among subcomponents. The design processes are inherently flexible and is critically dependant on the researcher's cognitive and creative abilities to produce effective solutions. DSR projects depends on social abilities such as teamwork to produce effective solutions (Hevner et al., 2004:81). In section 2.10, the research problem solved in this study was typified as a wicked problem, illustrating the suitability to use DSR as a research strategy to solve the research problem and answer the research questions.

Vaishnavi and Kuechler (2013) illustrate DSR as research strategy in IS schematically as portrayed in Figure 3.2:

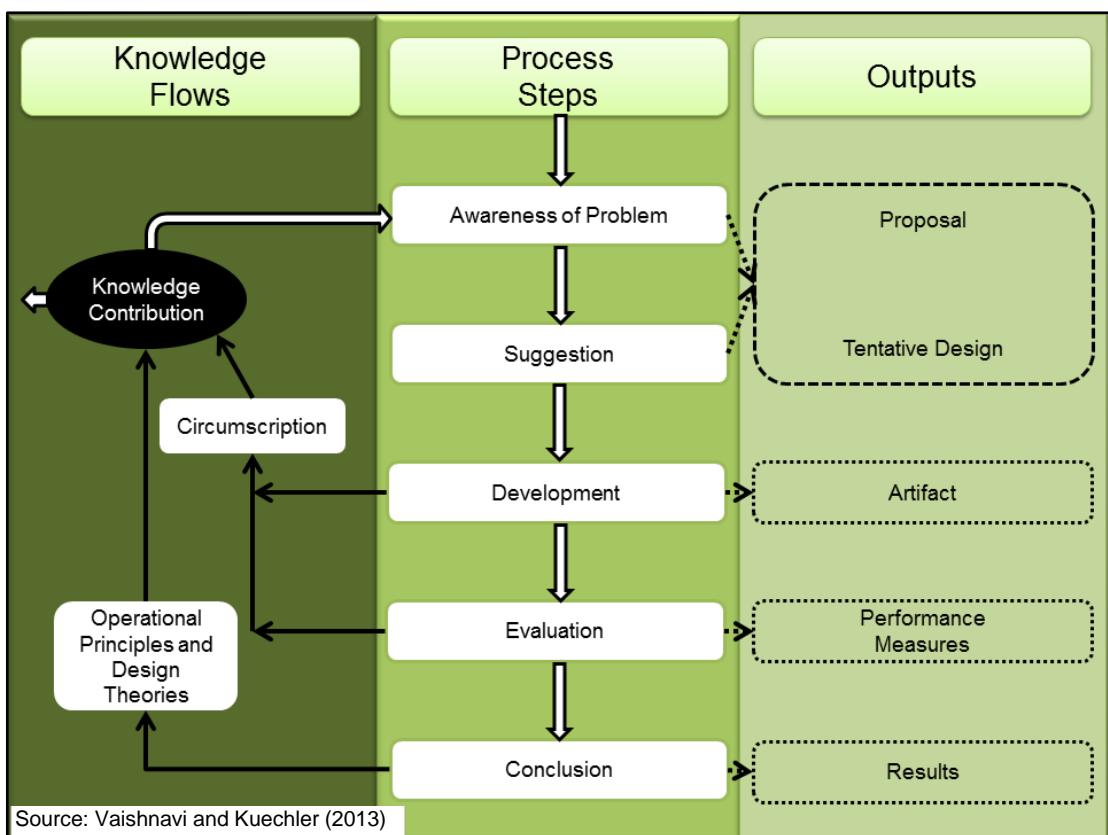


Figure 3.2: Design Science Research Process Model

Figure 3.2 illustrates one DSR Cycle that can be repeated numerous times until the desired results of the research project are accomplished. The process steps⁵⁸ are: Awareness of a problem, Suggestion, Development, Evaluation, and Conclusion. Each process step results in an output. Knowledge can be generated during the Development Step, Evaluation Step or Conclusion Step. When knowledge is fed back to another cycle of Awareness and Suggestion, it is called *circumscription*.

⁵⁸ For the purpose of this study, a decision was made to capitalize any reference to the five Steps of the DSR process model, whether abbreviated or listed in full.

Knowledge contribution during the process steps is the result of some restriction or constraints to complete the process identified during a specific process step. Once a final conclusion is reached after the final DSR Cycle, the operational principles and design theories resulting from all the DSR Cycles represents the knowledge contribution of the DSR project.

Awareness of the Problem: A DSR process starts with the Awareness Step of a problem that “may come from multiple sources including new developments in industry or in a reference discipline” (Vaishnavi & Kuechler, 2013:7). Readings in other disciplines may stimulate opportunities for new findings in the researcher’s field. The Awareness Step results in a proposal for a new research effort.

Suggestion: The Suggestion Step follows on the Awareness Step and is linked to the output of the Awareness Step, i.e. the proposal, via the tentative design as output of the Suggestion Step, to solve the problem. The suggestion to solve the problem can be a tentative design “or at least the germ of an idea for problem solution” (Vaishnavi & Kuechler, 2013:8). The Suggestion Step is essentially a creative step in problem solving.

Development: The tentative design is further developed and implemented during the Development Step. The techniques and procedures followed during the Development Step depend on the desired output (section 3.8). The output of the Development Step is an artefact. In IS an artefact is frequently used as a prototype to demonstrate the feasibility of addressing a problem (March & Storey, 2008). Hevner et al. (2004:77) defines artefacts as “*constructs* (vocabulary and symbols), *models* (abstractions and representations), *methods* (algorithms and practices), and *instantiations* (implemented and prototype systems)”. Constructs are also described as “vocabulary and conceptualizations that enable communication and description of problems (phenomena, possibly within a causal chain), solution components, constraints, and objectives for the designed artefact” (March & Storey, 2008:726).

The Development Steps of the respective DSR Cycles in this study (Figure 3.3) resulted in an artefact as an output of the specific DSR Cycle.

Evaluation: The artefact or developed tentative design is evaluated against the criteria set in the proposal. Deviations are noted and explained and can lead to a new Awareness Step. The results are then fed back into another Suggestion Step thus repeating the DSR Cycle.

Conclusion: The conclusion of the contribution can be the end of a research cycle or the result of a research project. The conclusion is reached when either the overall research problem is solved or the research question is answered. The results of the research project are reported on during the conclusion, thus providing the research or knowledge contribution of the research project.

This study consists of a Main DSR Cycle and four sub-DSR Cycles and is schematically illustrated in Figure 3.3 and described in sections 3.6.1 to 3.6.5.

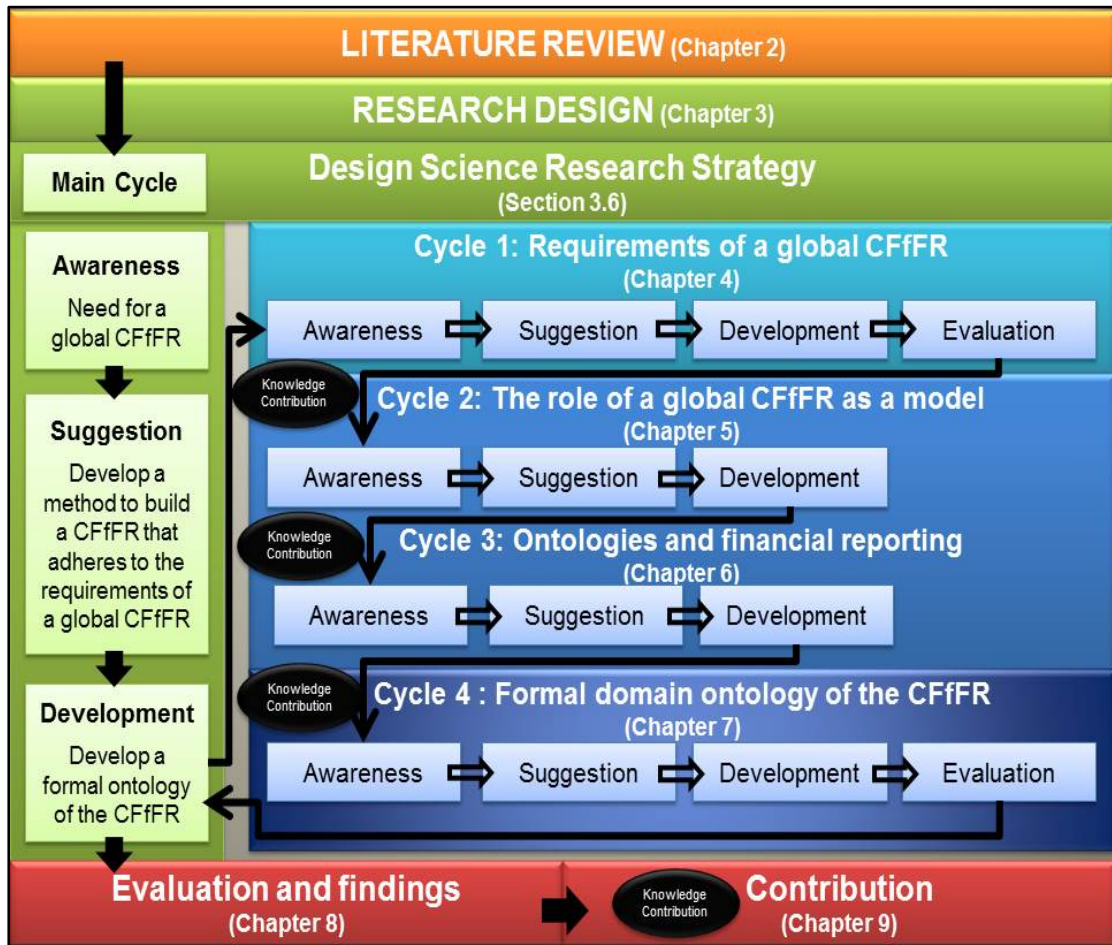


Figure 3.3: DSR as research strategy

3.6.1 DSR as Research Strategy: The Main DSR Cycle

The Awareness Step of the Main DSR Cycle follows directly from the description of the historical development of the CFfFR (Chapter 2). The need for a global CFfFR was identified as a wicked problem in section 2.10. Hevner et al. (2004) proposes DSR as a strategy to investigate wicked problems. The main and three sub-research questions are formulated to provide answers on how the use of ontology technologies could contribute towards the improvement of the CFfFR to be closer to a global CFfFR by designing a CFfFR ontology.

The proposal resulting from the Awareness Step lead to the suggestion to build a CFfFR ontology that could adhere to more of the requirements of a global CFfFR than the CFfFR. The tentative design included a search in current accounting literature and in other disciplines for technological developments, theories and guidelines on how to develop a conceptual framework that could be globally acceptable. It was *suggested* that a formal domain ontology of the CFfFR as tentative design could produce a method to assist in developing a conceptual framework that could be globally acceptable as it would be inherently consistent and clearly formulated. The building of a formal domain ontology of the CFfFR would be a

novelty in financial reporting as it proposes a new functionality of the application of ontology technologies.

The Development Step of the Main DSR Cycle went through four sub-DSR Cycles in order to develop a formal domain ontology of the CFfFR (Figure 3.3). According to the OLC, adopted and adapted from Neuhaus et al. (2013) (Figure 3.8), the first phase of designing an ontology is to develop the requirements of the ontology. The tentative design was expanded to establish the requirements of a global CFfFR in DSR Cycle 1 (Figure 4.6). Once the requirements of a global CFfFR were determined and the CFfFR evaluated against these requirements, the role of a global CFfFR within financial reporting as a model was determined in DSR Cycle 2 (Figure 5.12).

The role of a global CFfFR was identified as equal to a meta-metamodel in computing based on idealised assumptions in order to be a truth bearer (Mäki, 2011) of the CFfFR. The knowledge contribution of DSR Cycle 2 led to a further interdisciplinary investigation into the role and use of ontologies in philosophy and computing respectively in DSR Cycle 3. During DSR Cycle 3 it was established that it might be possible to build a formal domain ontology of the CFfFR, testing the idealised assumptions identified in DSR Cycles 1, 2 and 3 (section 5.4 and 6.5).

In DSR Cycle 4, a formal domain ontology of the CFfFR was developed using ontology technologies developed in computing (section 3.8.3). The development of the formal domain ontology consists of four iterations, with each iteration expanding on the knowledge obtained from the previous iterations.

The final output of DSR Cycle 4, the artefact as output of the main DSR Cycle (section 7.6), is a formal domain ontology formalising the most basic classes and relationships needed to provide decision-useful information to the users of financial reports (Figure 7.30 and Figure 10.2). This formal domain ontology of the CFfFR complies with the definition of a model artefact according to the definition of an artefact (Hevner et al., 2004; March & Storey, 2008). The CFfFR ontology is an abstraction and representation of the most basic classes and relationships in the financial reporting domain needed to provide decision-useful information to the users of financial reports.

In Chapter 8 the design process of CFfFR ontology was evaluated to determine if the main and sub-research questions were answered. The CFfFR ontology was evaluated by running the reasoner to test if the classes and relationships are internally consistent and comparing if the classes and relationships comply with the competency questions posed in section 7.2. By building the CFfFR ontology, the CFfFR was evaluated against the requirements and role of the ideal CFfFR. The findings resulting from this evaluation process indicate how the CFfFR can be improved to be nearer to being globally acceptable.

The Main DSR Cycle concludes when it is determined that the research questions are answered by documenting the knowledge contributions. The knowledge contribution of the Main DSR Cycle is a combination of the knowledge contributions

of all the DSR Cycles. The knowledge contributions resulting from the DSR strategy followed in this study are summarised in Chapter 9.

3.6.2 DSR Cycle 1: Requirements of a Global CFfFR

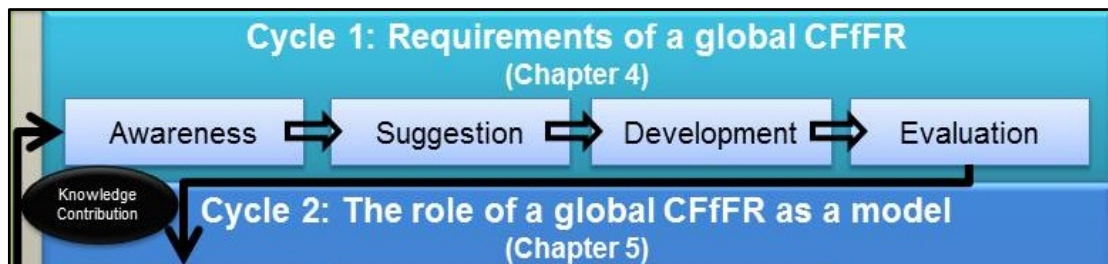


Figure 3.4: DSR Cycle 1

The Awareness Step for DSR Cycle 1 links to the first phase of the OLC (Figure 3.8) in which the requirements of the ontology are developed (Vaishnavi & Kuechler, 2013). The first problem to solve was to identify the requirements that a CFfFR should adhere to in order to be globally acceptable. In order to determine how the building of a CFfFR ontology could assist in improving the CFfFR to be more globally acceptable, the requirements of a global CFfFR had to be determined. The CFfFR ontology was tested against these requirements to determine if it adheres to more of the requirements than the CFfFR. The output of the Awareness Step (Figure 3.3) was the proposal to identify such requirements.

The suggestion was to investigate literature regarding conceptual frameworks in accounting to identify requirements and a definition for a global CFfFR from the literature. The tentative design as output of the Suggestion Step was to perform a systematic review on documents and webpages regarding conceptual frameworks (including discussions on postulates and principles of accounting) in accounting and to abstract from the literature the possible requirements for a CFfFR to be globally acceptable.

During the Development Step of DSR Cycle 1 a systematic review protocol was developed (Table 3.3). A systematic review was performed on the literature as indicated in the protocol and the requirements were abstracted from the literature. The identified requirements serve as the output of the Development Step. The artefact produced during DSR Cycle 1 as the output of the Development Step can be described as a construct (Hevner et al., 2004). The requirements (Figure 4.6) and the proposed definition (section 4.7) for a global CFfFR provides the vocabulary and conceptualisations to enable communication and a description regarding the problem on what is required for a CFfFR to be more globally acceptable.

The Evaluation Step of the requirements and proposed definition of a global CFfFR complies with the criteria of the first step of the OLC. It was determined that it is possible to test a CFfFR ontology against these requirements, as ontology technologies allows for the testing of logical consistency between classes and relationships in an ontology. The evaluation led to a transition from DSR Cycle 1 to DSR Cycle 2. The *circumscription* identified during the evaluation resulted in a new Awareness Step, that the role of a global CFfFR should also be determined in order

to test the CFfFR against the identified requirements. The *knowledge contribution* leads to the Awareness Step of DSR Cycle 2.

3.6.3 DSR Cycle 2: The Role of a Global CFfFR as a Model



Figure 3.5: DSR Cycle 2

During the Evaluation Step of DSR Cycle 1 the awareness was gained that the role of a global CFfFR as a model within accounting has to be clarified in order to test the CFfFR against the requirements and proposed definition identified in DSR Cycle 1. The role of a global CFfFR was investigated in DSR Cycle 2.

The Suggestion Step entailed the investigation of the functioning and role of models within other disciplines, as no evidence to explain the role of the CFfFR as a model within financial reporting could be obtained. The tentative design to investigate the role of models within philosophy and computing as a formal ontology comprises both philosophical and computing elements.

During the Development Step an interdisciplinary investigation was undertaken to determine the role of a global CFfFR by investigating some models in philosophy and computing. The output of the Development Step resulted in three artefacts. The first artefact, the idea of an ideal CFfFR, can be classified as a construct. The idea of an ideal CFfFR and that an ideal CFfFR could serve the role of a truth bearing model (Figure 5.5 and Figure 5.6) as explained from a philosophical or scientific perspective (Mäki, 2011) provides a vocabulary and conceptualisation that could enable communication regarding the role of the CFfFR as a model. The second artefact of DSR Cycle 2 is a model in which the ideal role of the CFfFR is described as a meta-metamodel according the four level OMG hierarchy (OMG, 2014) within the financial reporting domain (Figure 5.12). From the discipline of computing, it was determined and confirmed that an ideal CFfFR should have the role of a meta-meta type model (Kühne, 2005; Kühne, 2006b). The third artefact, related to the idea of an ideal CFfFR, is the ideal assumptions of an ideal CFfFR. The ideal assumptions can be classified as a construct artefact as it provides the vocabulary and the conceptualisation to communicate regarding an ideal and possible global CFfFR. The knowledge obtained during the Development Step in DSR Cycle 2 left the study with the circumscription of how to use this knowledge to answer the third and main research questions.

3.6.4 DSR Cycle 3: Ontologies and Financial Reporting

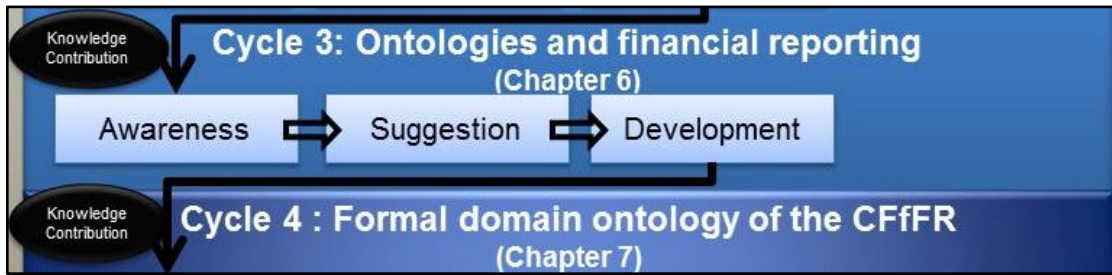


Figure 3.6: DSR Cycle 3

The Awareness Step of DSR Cycle 3 flows directly from the Development Step outputs of DSR Cycle 2. The role of an ideal CFfFR as a meta-metamodel stimulated the need to investigate if and how an ideal CFfFR can function as an ontology when compared to the four level OMG hierarchy.

During the Suggestion Step of DSR Cycle 3, an interdisciplinary investigation was proposed in order to establish the applicability of ontologies to evaluate the role and requirements of an ideal CFfFR. As the term and concept ontology originates from philosophy, philosophy was the first discipline investigated to determine the applicability and requirements of ontologies relating to an ideal CFfFR.

The second discipline investigated was computing. The purpose of the investigation was to determine if ontology technologies as used in computing could contribute towards the development of a method to build a CFfFR that adheres to the requirements of a global CFfFR. The tentative design output of the Suggestion Step was to investigate the applicability of ontologies in philosophy and computing.

During the Development Step of DSR Cycle 3, an interdisciplinary investigation between philosophy, computing and financial reporting was conducted to establish if and how the ideal CFfFR could serve as a formal upper ontology for the financial reporting domain. The outputs of DSR Cycle 3 resulted in two artefacts. The first artefact is in the form of a model. The model demonstrates the role of the ideal CFfFR as a formal domain ontology according to the Object Management Group (OMG) four level hierarchy (Figure 6.6). The second artefact is a construct in the form of the conceptualisation on how a CFfFR ontology could contribute towards answering a research question and assist in improving the CFfFR to comply with more of the requirements of a global CFfFR. The outputs of DSR Cycle 3 left the gap to use the knowledge obtained from DSR Cycles 1, 2 and 3 to attempt the construction of a formal domain ontology of the CFfFR in DSR Cycle 4.

3.6.5 DSR Cycle 4: A Formal Domain Ontology of the CFfFR

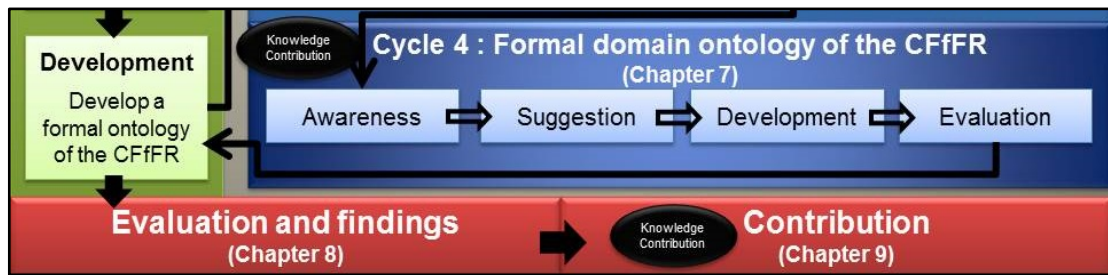


Figure 3.7: DSR Cycle 4

The results of the Development Step of DSR Cycle 3 are the awareness that a formal domain ontology of the CFfFR could assist in testing the CFfFR against the requirements, role and model theories determined during DSR Cycles 1, 2 and 3. The suggestion was to build formal domain ontology using ontology technologies of the CFfFR.

During the Development Step ontology technologies (Protégé, FACT++ and OWL, DL) were used to build the formal domain ontology of the CFfFR. The CFfFR was analysed and classified into classes and relationships according to the requirements of the OLC Model as proposed by Neuhaus et al. (2013). The formal domain ontology of the CFfFR went through four iterations for the CFfFR to be constructed. In total, 5 artefacts were produced during DSR Cycle 4, one construct artefact and 4 model artefacts.

The first artefact, laying the foundation to build the ontology, is a construct providing the basic assumptions to build a formal domain ontology and the use of the OLC Model in the financial reporting domain (section 7.2). During iteration 1, time (section 7.2.3) and the definitions of the elements of the SFP was modelled (section 7.3), producing the first model artefact.⁵⁹ During iteration 2, the basic classes and relationships of the SFP elements were identified (section 7.4.1) and logically consistent definitions for these elements were proposed (sections 7.4.2b), 7.4.3b), and 7.4.4b)).⁶⁰ In iteration 3, the key classes and relationships in the CFfFR ontology (section 7.5.1), and the decision process to determine decision-useful information for the CFfFR ontology (section 7.5.2) were developed.⁶¹ During iteration 4 the CFfFR ontology is the final output of DSR Cycle 4 and is also the model output of the main DSR Cycle (section 7.5.3).

The artefact resulting directly from the building process of the CFfFR ontology is a construct related to the findings on logical inconsistencies, incompleteness, unintended meanings and implied knowledge detected in the CFfFR during the building process of the CFfFR ontology. These findings provide conceptualisations and the description of problems that could be discussed in order to improve the CFfFR.

⁵⁹ This artefact was published in (Gerber et al., 2014).

⁶⁰ This artefact was published in (Gerber, Gerber, Van der Merwe, et al., 2015).

⁶¹ Some elements of this artefact were published in (Gerber, Gerber, & Van der Merwe, 2015).

The first aspect of evaluation was to determine if it is possible to build a formal domain ontology of the CFfFR. The second aspect was to determine if a formal domain ontology of the CFfFR adheres to more requirements of a global CFfFR than the CFfFR. Part of the evaluation was the documentation of logical inconsistencies, incompleteness, unintended meanings and implied knowledge detected during the building process of the formal domain ontology of the CFfFR. The evaluation and findings are documented in Chapter 8. The DSR project *concluded* with the knowledge contribution as provided in Chapter 9.

Table 3.1 summarises the artefacts developed during the different DSR Cycles. The table also indicates how the artefacts contributed towards answering the research questions.

Table 3.1: Summary of artefacts contributing towards answering the research questions in the DSR Cycles

	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7		
ARTEFACT	Development Step moves to DSR Cycle 1.	Construct: Requirements & Definition of a global CFfFR. (Sections 4.6 and 4.7)	Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4). Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4).	Model: The role of the ideal CFfFR as a formal domain ontology according to OMG four level hierarchy (section 6.4).	Construct: <ul style="list-style-type: none"> Basic assumptions to build a formal domain ontology of the CFfFR (section 7.2.2). Use of OLC Model in financial reporting domain (section 7.2). 		
			Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5). Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5).	Construct: Conceptualisation on how a CFfFR ontology could contribute towards the research questions (section 6.4.3).	Model: Iteration 1 (section 7.3): <ul style="list-style-type: none"> Modeling of time. Modeling definitions of asset, liability and equity. 		
	Model: The CFfFR ontology indicating internal incoherence's, logical inconsistencies, implied knowledge and incompleteness of CFfFR (sections 7.4, 7.5 and 7.6).		Construct: Ideal assumptions provide vocabulary and conceptualisation to communicate regarding ideal and possible global CFfFR (section 5.4).		Model: Iteration 2 (section 7.4): <ul style="list-style-type: none"> Identification of basic classes and relationships in SFP element definitions. Proposed SFP element definitions that are logically consistent. 		
					Model: Iteration 3 (section 7.5): <ul style="list-style-type: none"> Identification of key classes and relationships in the CFfFR ontology. Decision process model. 		
					Model: Iteration 4 (section 7.6): Building the CFfFR ontology.		
	Main RQ	SRQ 1	SRQ 1	SRQ 2	SRQ 3	SRQ 3	Main RQ

The main research question is answered with the development of the CFfFR ontology indicating the internal incoherence's, logical inconsistencies, implied knowledge and incompleteness in the CFfFR. SRQ 1 is partially answered with the development of the construct artefact in Chapter 4 during DSR Cycle 1. In Chapter 5, during DSR Cycle 2, the rest of SRQ 1 is answered with the development of the idea of an ideal CFfFR as truth bearing model (a construct artefact). The indication of the role of the ideal CFfFR as a meta-metamodel (a model artefact) and the ideal assumptions of an ideal and global CFfFR (a construct artefact) answered SRQ 2.

In Chapter 6 during DSR Cycle 3, SRQ 3 was partially answered with the establishment of the role of the ideal CFfFR as a formal domain ontology according to the OMG four level hierarchy. The development of the how a CFfFR ontology could contribute towards a global CFfFR also contributed towards answering SRQ 3. With the development of the CFfFR ontology in Chapter 7 during DSR Cycle 7, SRQ 3 and the main research question were answered. The matrix in Table 3.2 summarises how the different research questions are answered during the DSR Cycles.

Table 3.2: Matrix of research questions and DSR strategy

RESEARCH QUESTION	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
MAIN RQ	√				√
SRQ 1		√	√		
SRQ 2			√		
SRQ 3				√	√

3.7 Time Horizon

This study focuses on the CFfFR as published in September 2010 by the IASB. Although the CFfFR are currently under revision and will evolve over time, the document under investigation represents a static document at a specific time in history. The study is classified as a cross-sectional study and not a longitudinal study.

3.8 Research Techniques and Procedures

According to Myers (2013:25) "a research method is a *strategy of enquiry*". The research method is the way to find data about the reality that is being researched. A research method builds on a philosophical assumption (Myers, 2013) and influences the way a researcher collects and evaluates data, and verifies the results of the research process. The overall research methodology for the study is an interpretivist qualitative study adopting an interpretivist ontological view of reality. However, different methods of enquiry are utilised to answer the three different sub-research questions.

The following research techniques were used during the study: Chapter 4, Systematic Review (section 3.8.1); Chapters 5 and 6, an interdisciplinary investigation (section 3.8.2); Chapter 7, ontology technologies (section 3.8.3).

3.8.1 Systematic Review

The first sub-research question is answered in Chapter 4 using a systematic review⁶² method (Biolchini, Mian, Natali, Conte, & Travassos, 2007; Harden & Thomas, 2010; Mian, Conte, Natali, Biolchini, & Travassos, 2005). Systematic review is commonly used in the health sciences with the Cochrane Handbook for Systematic Reviews of Interventions as standard setter (Green, Higgins, Alderson, Clarrke, Mulrow, et al., 2008; Thomas & Harden, 2008). The method is also utilised in software engineering research (Biolchini, Mian, Natali, & Travassos, 2005; Biolchini et al., 2007; Mian et al., 2005) and information systems (Okoli & Schabram, 2010).

The reason for using a systematic review method is to enable the researcher to derive a definition and determine the requirements for a global CFfFR from literature. This method can be viewed as an inductive approach, starting from the literature and working towards a generalisation of different requirements and definitions. Although the research design is viewed as an inductive approach, no statistical analysis is used.

Systematic review is a method to obtain relevant results from a body of literature (Mian et al., 2005). In software engineering systematic review is a specific methodology developed to gather and evaluate evidence regarding a specific topic (Biolchini et al., 2007). Harden and Thomas (2010:751) defines systematic review as “an explicit method to conduct a review ... that follows standard stages and methods”.

Mian et al. (2005) identify the following phases during a systematic review process: planning, execution and result analysis. According to Harden and Thomas (2010) a research question forms the starting point of a systematic review, followed by a sampling stage, data collection stage and data analysis stage. All three stages were performed in this study (Table 3.3).

A systematic review is planned in a formal and systematic way. During the planning stage, the type of acceptable evidence is determined and stated at the beginning. During the sampling stage, information is retrieved according to the planned protocol. Should relevant evidence be collected that does not form part of the planning stage, the data collection protocol is reviewed to include the additional information and a new version is created (Mian et al., 2005).

During the execution or data collection stage the search is executed and the studies obtained are evaluated according to the established criteria. After the review execution the results are summarized and analysed according to the methods defined during the Planning Phase (Mian et al., 2005).

⁶² Synonyms for this methodology are: “overview, research review, research synthesis, research integration, systematic overview, systematic research synthesis, integrative research review, and integrative review” (Biolchini et al., 2007:135).

The systematic review method was used in this study based on an interpretative philosophical assumption as judgements were made during the review process regarding the literature to use in order to identify relevant information, sorting, categorising and summarising the selected information in order to answer the research question. During DSR Cycle 1 (section 3.6.7), a systematic review method was followed to determine the requirements of a global CFfFR.

In this study the systematic review protocol template suggested by Mian et al. (2005) is adopted and adapted in Chapter 4 to answer the first sub-research question.

Table 3.3: Systematic review protocol

CONTROL	PROTOCOL
PLANNING STAGE	
1. <i>Question formularisation: Stating the research objectives</i>	
1.1 <i>Question focus:</i>	The research objective is to determine a definition and requirements for a global CFfFR.
1.2 <i>Question quality and amplitude:</i>	In a global economy the accounting community is in need of a global CFfFR to guide the setting of globally acceptable accounting standards.
<ul style="list-style-type: none"> • <i>Research problem:</i> • <i>Research question:</i> 	<p>What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged? The systematic review is focussed on answering SRQ 1 and applied during DSR Cycle 1.</p>
<ul style="list-style-type: none"> • <i>Keywords and synonyms:</i> 	<ul style="list-style-type: none"> • Requirements of a conceptual framework; • Definition of a conceptual framework; • Objective of a conceptual framework; • Function of a conceptual framework in accounting; • Need for a conceptual framework for accounting; • Purpose of the conceptual framework; • IASB and FASB joint project; • Development of the conceptual framework; • Postulates and principles in accounting; • Reasons and motivation for a conceptual framework • Procedures to draft a conceptual framework.
<ul style="list-style-type: none"> • <i>Intervention:</i> 	Publications discussing the definition, need, objectives and requirements of a global CFfFR to be identified.
<ul style="list-style-type: none"> • <i>Control:</i> 	During the literature review on the historical development of the CFfFR some resources dealing with the requirements and needs for a global CFfFR were identified. These resources formed a basis to start the systematic review.
<ul style="list-style-type: none"> • <i>Effect:</i> 	It is expected that discussions in the literature will be found indicating the requirements, needs, role, and definition of a global CFfFR.
<ul style="list-style-type: none"> • <i>Outcome measure:</i> 	No metrics will be applied. Sources with relevant information are studied and documented.
<ul style="list-style-type: none"> • <i>Population:</i> 	The population is observed until a stage saturation is reached.
<ul style="list-style-type: none"> • <i>Application:</i> 	Some clarity will be provided to the accounting community regarding what are perceived as the need and requirements of a global CFfFR. A definition for a global CFfFR is derived from the literature reviewed.
<ul style="list-style-type: none"> • <i>Experimental design:</i> 	No statistical analysis is applied as the information obtained is not in a statistical format. Trends in concepts and ideas regarding the need and requirements of a global CFfFR are identified and summarised.

CONTROL	PROTOCOL
2. Sources Selection: Sources for primary studies searches	
2.1 Sources selection criteria definition:	Conceptual frameworks and notes published by the FASB and IASB are considered to be primary sources. Important studies that preceded the development of conceptual frameworks by the FASB and the IASB are also considered but not viewed as primary sources.
<ul style="list-style-type: none"> Studies languages: 	Primary studies are mainly obtained in English. Other languages also considered are Afrikaans, Dutch and German.
2.2 Sources identification:	
<ul style="list-style-type: none"> Sources search methods: 	Primary documents are obtained from the websites of the FASB and the IASB. The team revising the CFfFR at the IASB is contacted via email.
<ul style="list-style-type: none"> Search string: 	See keywords and synonyms above.
<ul style="list-style-type: none"> Sources list: 	The following data basis and search engines are used: <ul style="list-style-type: none"> University of Pretoria library e-resources and e-journals; ProQuest, Accounting & Tax, Accounting; EbscoHost; Science Direct; JStor; Wiley Online Library and Google Scholar.
2.3 Sources selection after evaluation:	<ul style="list-style-type: none"> Information regarding the function and criteria regarding a global CFfFR are evaluated.
2.4 References checking	References are checked by study supervisors when the results are presented in a written document.
2. Studies selection:	
3.1 Studies definition:	Studies dealing directly with the drafting, purpose and criteria of a conceptual framework for accounting.
<ul style="list-style-type: none"> Studies inclusion and exclusion criteria definition: 	Inclusions: <ul style="list-style-type: none"> Studies dealing with the theory behind and need for a global CFfFR. Studies dealing with critique on and problems with conceptual frameworks. Studies discussing the purpose of conceptual frameworks in accounting. Studies dealing with the motivation to draft a conceptual framework for accounting. Important studies preceding the development of the FASB and IASB conceptual frameworks. Exclusions: <ul style="list-style-type: none"> Studies dealing with detail on the content of conceptual frameworks for accounting. Studies not related to the conceptual framework for accounting.
<ul style="list-style-type: none"> Study types definition: 	Primary sources are: <ul style="list-style-type: none"> The respective conceptual frameworks published by the FASB and the IASB; Documents published by professional bodies influencing the CFfFR of the IASB (see the literature review). Secondary sources dealing directly with the drafting, need and requirements of a conceptual framework or postulates and principles as it was known during the 1960s. These studies include books, e-books, peer reviewed journal papers, dissertations, reports, minutes of meetings, and web pages of organisations. Selection is a qualitative observation, based on the judgement of the researcher regarding relevance to the study and information needed at that stage.

CONTROL	PROTOCOL
<ul style="list-style-type: none"> Procedures for study selection: 	<p>Selection procedure for studies:</p> <ul style="list-style-type: none"> Primary resources are obtained from the different standard setting bodies. A web search is done using the keywords and search strings on the different sources identified. A first selection on web searches is done by evaluating the titles of studies. A second selection is made from the first selection judged on information in the abstract. A third selection is made from the second selection: Studies selected during the second selection stage are downloaded and evaluated by reading the introduction and conclusions of the study. Studies selected during the third selection stage are studied and relevant information is captured. Further selections based on the third and final selection. The selection cycle is repeated from the first to the third selection stages: <ul style="list-style-type: none"> The references of selected studies are scrutinised for possible relevant studies. Documents citing the selected studies are scrutinised for possible relevant additional studies. The searching cycle is repeated if new information becomes available regarding certain aspects of the study. Based on the newly required information, new search strings are developed and refined until relevant information is found. Studies selected are included in a Mendeley database.
EXECUTION STAGE	
3.2 Selection execution:	
<ul style="list-style-type: none"> Initial studies selection: 	556 documents, studies, reports, dissertations and web pages were initially selected and included in the Mendeley data base program.
<ul style="list-style-type: none"> Studies quality evaluation: 	The quality of the studies are evaluated and selected based on the criteria to provide information on the need, purpose and requirements of a global CFfFR.
<ul style="list-style-type: none"> Selection review: 	The final selection of 45 documents, studies, reports, dissertations and web pages is included in the references list at the end of the document.
4. Information extraction:	
4.1 Information inclusion and exclusion criteria definition:	The information is selected based on the contribution towards the clarification of the need, purpose and requirements of a global CFfFR.
4.2 Data extraction forms:	No forms are used. Information is documented and sorted as it is extracted.
4.3 Extraction execution:	
<ul style="list-style-type: none"> Objective results extraction <ul style="list-style-type: none"> Study identification Study methodology Study results Study problems 	Not applicable as this is an interpretive study - extraction is subjective based on the judgement of the researcher.
<ul style="list-style-type: none"> Subjective results extraction <ul style="list-style-type: none"> Information through authors General impressions and abstractions 	The relevant information is selected by judgement, documented and roughly sorted according to the election criteria.

CONTROL	PROTOCOL
4.4 Resolution of divergences among reviewers:	Does not form part of this study.
RESULT ANALYSIS	
5. Results Summarisation:	
5.1 Results statistical calculus:	Not applicable
5.2 Results presentation in tables:	<p>The documents, studies, reports, dissertations and web pages are inspected for the following categories and grouped accordingly:</p> <ul style="list-style-type: none"> • Need for a global CFfFR; • The objective of a conceptual framework; • Requirements of a global CFfFR; • Information that can contribute towards a definition for a global CFfFR. <p>The categories identified above are grouped together and then analysed for similar and conflicting trends and arguments. The different trends and arguments are colour coded and summarised to provide a summary of the arguments and trends.</p>
5.3 Sensitivity analysis:	Not applicable in this qualitative study.
5.4 Plotting:	Not applicable in this qualitative study.
5.5 Final comments	
<ul style="list-style-type: none"> • Number of studies: 	A total of 45 documents, studies, reports, dissertations and web pages are used to provide the information.
<ul style="list-style-type: none"> • Search, selection and extraction bias: 	As the researcher is involved in the selection, analysis and evaluation of the information the selection process can be viewed as biased. Another researcher may identify more or different needs, requirements and definitions.
<ul style="list-style-type: none"> • Publication bias: 	The results need to be evaluated by a peer review process of publication.
<ul style="list-style-type: none"> • Inter-reviewers variation: 	The study supervisors review the results before submission for examination.
<ul style="list-style-type: none"> • Results application: 	Should the results be published via a peer review process it could contribute towards the drafting of a global CFfFR for Financial Reporting?
5.6 Recommendations	<p>It is not possible to confirm the role of a global CFfFR towards the setting of financial accounting standards from the systematic review. In the next section, the role of a conceptual framework is investigated using modeling theories from philosophy of science and computing. The two disciplines have progressed on the utilization of models for scientific research.</p> <p>Further studies are needed to either confirm or adjust the proposed definition and requirements for a global CFfFR.</p>

3.8.2 Interdisciplinary Research

In order to refine the requirements identified during the systematic review process in Chapter 4 and to establish the role of a global CFfFR within financial reporting, the study moved to an interdisciplinary investigation between philosophy, computing and accounting.⁶³ Within the DSR strategy, design cycles two and three are conducted using an interdisciplinary investigation.

⁶³ Lyall et al. (2011) discusses the benefits and constraints of interdisciplinary research.

The interdisciplinary research involved the following steps:⁶⁴

1. Identify the knowledge need in the primary discipline.
2. Identify the potential secondary discipline(s) that could contribute to provide and answer to the knowledge need in the primary discipline.
3. Identify complementary knowledge between the different disciplines.
4. Apply the complementary knowledge obtained from the secondary discipline(s) to the knowledge need identified in the primary discipline.
5. Report on the findings and contribution of knowledge in the primary discipline.

The following explains how the interdisciplinary investigation steps were executed during DSR strategy cycles two and three.

Table 3.4: Interdisciplinary research steps

DSR CYCLE 2 (Chapter 5)	DSR CYCLE 3 (Chapter 6)
Step 1: Identify the knowledge need	
The knowledge need was identified in DSR Cycle 1.	The knowledge need was identified in DSR Cycle 2.
The role of a global CFfFR had to be identified in order to test the CFfFR against the requirements identified in DSR Cycle 1.	The role and requirements of an ideal CFfFR as a meta-metamodel had to be investigated.
The suggestion was that the role of a global CFfFR can be determined if it can be viewed as a model.	The suggestion was to establish the applicability of ontologies to evaluate the role and idealised assumptions of the ideal CFfFR.
The role of the CFfFR viewed as a model was identified as the knowledge needed to answer the question.	The role of the ideal CFfFR, viewed as an ontology, was identified as the knowledge needed to answer the question.
A satisfactory discussion regarding the role of a global CFfFR as a model could not be identified within accounting literature during the DSR Cycle 1.	A satisfactory discussion regarding the role of the ideal CFfFR as an ontology could not be identified within accounting literature in DSR Cycle 1 and the interdisciplinary investigation conducted in DSR Cycle 2.
Step 2: Identify the secondary disciplines	
The secondary disciplines identified that could contribute to the knowledge need were:	The secondary disciplines identified that could contribute to the knowledge need were:
Philosophy of science: Within philosophy of science, a discussion regarding the role, value and requirements of models to generate knowledge was identified.	Philosophy: Ontology as discipline originated in philosophy and forms the basis of the theory of ontologies in computing.
Computing: The use of models to represent specified domains is commonly used in computing.	Computing: In computing, conceptual modeling and ontologies are used to formally represent specific domains.
Step 3: Identify complementary knowledge	
Philosophy of science: The use of idealised models as truth bearers, as	Philosophy: The applicability of ontology as discipline

⁶⁴ These steps were developed in order to systematise the investigation.

DSR CYCLE 2 (Chapter 5)	DSR CYCLE 3 (Chapter 6)
argued by Mäki (2011; 2008), was identified as complementary knowledge that could contribute to determine the role of a global CFfFR as a model.	includes the background regarding the development of the use of formal languages, and logical consistencies as prerequisite for cross cultural acceptance of theories were identified as complementary knowledge from philosophy.
Computing: The classification of type and token models as well as the characteristics of metamodels and meta-metamodels as discussed by Kühne (2005; 2006b) was identified as complementary knowledge that could contribute to determine the role of a global CFfFR as a model.	Computing: The requirements of ontologies in computing, the use of formal upper domain ontologies and the Object Management Group (OMG) four level hierarchy were identified as complementary knowledge from computing.
Step 4: Apply the complementary knowledge	
Philosophy of science: The characteristics and theory of idealised models as truth bearers were compared and applied to the CFfFR. Based on the knowledge obtained from philosophy of science, idealised assumptions of an ideal CFfFR were drafted.	Philosophy: The value of the use of formal languages and the importance of logical consistency as prerequisite for cross-cultural acceptance of theories was applied to refine the role and requirements of the ideal CFfFR. It also contributed to expand the idealised assumptions of an ideal CFfFR to contribute knowledge in order to be able to develop a global CFfFR.
Computing: The characteristics of type and token, metamodels and meta-metamodels were applied to the financial reporting domain to refine the requirements and determine the role of the ideal CFfFR that could contribute towards a global CFfFR.	Computing: The requirements of ontologies in computing, the use of formal upper domain ontologies and the Object Management Group (OMG) four level hierarchy were used to position and justify the role of the ideal CFfFR as an upper domain ontology within the financial reporting domain.
Step 5: Report on the findings	
The findings were reported in Chapter 5.	The findings were reported in Chapter 6.

3.8.3 Ontology Technologies: The OLC Model

Ontology technologies are used as modeling a technique in Chapter 7 to test the CFfFR against the idealised assumptions, requirements and role of a global CFfFR as determined in Chapters 4 to 6. The Ontology Life Cycle (OLC) Model suggested by Neuhaus et al. (2013) (Figure 3.8) was adopted and adapted as a method to build the formal ontology of the CFfFR.

The OLC Model was chosen as a high-level method to develop the formal representation of the CFfFR. Leading experts in computing ontologies during the 2013 Ontology Summit developed the OLC Model to evaluate ontologies.⁶⁵ The document by Neuhaus et al. (2013:2) “represents a synthesis of a subset of ideas presented, discussed, and developed over the course of ... four months, and reflects the contributions of the Summit’s participants and the consensus of the Summit community”.

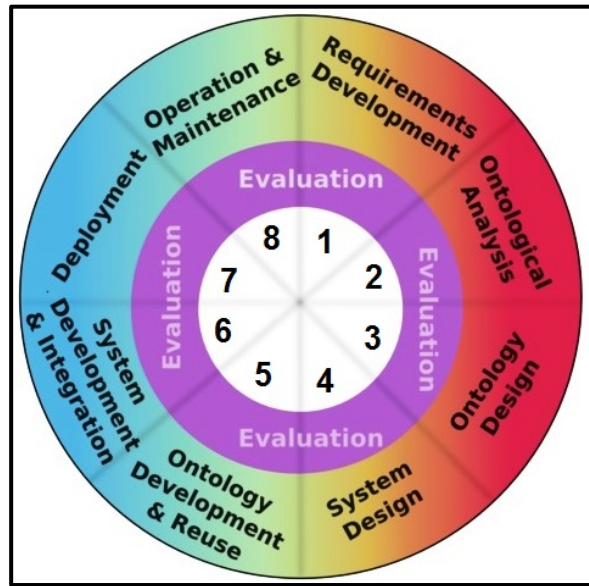


Figure 3.8: An OLC Model from Neuhaus et al. (2013)

The OLC Model consists of the following eight Phases⁶⁶ (Neuhaus et al., 2013):

- a. Phase 1: Requirements development;
- b. Phase 2: Ontological analysis;
- c. Phase 3: Ontology design;
- d. Phase 4: System design;
- e. Phase 5: Ontology development and reuse;
- f. Phase 6: System development and integration;
- g. Phase 7: Deployment and,
- h. Phase 8: Operation and maintenance.

Due to the scope and purpose of the study, only Phases 1-3 and 5 were performed in order to answer SRQ 3 and the main research question. The System design (Phase 4) and System development and integration (Phase 6) concerns the design of the computer system and integration of the ontology and other components into subsystems (Neuhaus et al., 2013). This study does not include the System design, Development, Integration, Deployment and Operation Phases.

Data collection takes place in the process of making modeling decisions and building the formal representation or ontology of the CFfFR. The modeling decisions, detected inconsistencies and unintended meanings form part of the findings of the study. The following is a short description of the different Phases in the OLC:

a) Phase 1: Requirements Development

During the Requirements Development Phase the expected and intended usages and interpretations of the ontology are determined. During this Phase, the

⁶⁵. The purpose of the ontology life cycle as published by Neuhaus et al. (2013:2) “is to advance the understanding and adoption of ontology evaluation practices”.

⁶⁶ For the purpose of this study, a decision was made to capitalize any reference to the 8 Phases of the OLC model, whether abbreviated or listed in full.

requirements of the ontology are specified using competency questions (Neuhaus et al., 2013). During Phase 1 of the OLC Model, the context, scope, initial requirements and a general understanding of the ontology is established. The requirements stated under Phase 1 are based on the work done during DSR Cycles 1, 2 and 3 (Chapters 4-6).

According to Neuhaus et al. (2013:5) the Requirements Phase should answer the following questions:

- *“Why is this ontology needed? (What is the rationale? What are the expected benefits?)* The need for a global CFfFR was argued in the literature review (Chapter 2). In sections 4.3.6 and 4.4.2 the need for internal coherent, logically consistent and an unambiguous CFfFR was indicated as some of the requirements of a global CFfFR. The ontology of the CFfFR is used to build a model and test if it is possible to get closer to the requirements of a global CFfFR as indicated in Chapters 4 and 5. The benefits of the ontology of the CFfFR are that during the building process unintended meanings in the natural text were detected. The reasoner indicated inconsistencies between classes and their relationships to the CFfFR when these classes and relationships were formalised.
- *What is the expected or intended usage (e.g. specified as use-cases, scenarios)?* The current use of the ontology of the CFfFR in this study is to determine if it is possible to contribute towards a global CFfFR. The ontology is used to identify unintended meanings in the natural text and to understand which classes are fundamental in the generation of a financial report. Future uses of the CFfFR ontology might be to link the ontology of the CFfFR with ontologies of accounting standards to test for inconsistencies between accounting standards and the CFfFR. The ontology of the CFfFR might also be used to provide a link with the XBRL project (section 6.4).
- *Which groups of users need to understand which parts of the ontology?* The users of the CFfFR (IASB, 2010a) as indicated in section 4.4.2 are the target audience of the ontology.
- *What is the scope of the ontology?* The scope of the CFfFR ontology is the financial reporting domain as portrayed in the natural text of the CFfFR and a specimen financial report.
- *Are there existing ontologies or standards that need to be reused or adopted?* There is no existing ontology to be used at this stage. Other ontologies in the accounting domain were indicated in section 6.4. These ontologies function on a different level and cannot be used in this study.
- *What are the competency questions?* The ontology must contain the most fundamental classes and relationships of principles providing decision-useful financial information to the primary users of financial reports.

- *Is the competency questions representative of all expected or intended usages?* The competency questions are related to the idealised assumptions provided in section 6.5.
- *What are the requirements from the operational environment?* As the ontology will not be employed (Phase 7) as part of a larger system there are no operational requirements. In future research a system may be developed to support the work done in this study.
- *What resources need to be considered during the ontology and system design Phases (e.g., legacy databases, test corpora, data models, glossaries, vocabularies, schemas, taxonomies, ontologies, standards, access to domain experts)?* The main resource is the CFfFR itself (IASB, 2010a). Other resources are implicit domain knowledge by domain experts.

b) Phase 2: Ontological Analysis

During the Ontological Analysis Phase the key entities of the ontology such as the individuals, classes/properties or as referred to in this study, *i.e.* concepts, and the relationships between them are identified. The concepts and relationships are also linked to the terminology used in the domain. The Ontological Analysis Phase “usually involves the resolution of ambiguity and the identification of entities that are denoted by different terms across different resources and communities” (Neuhaus et al., 2013:6).

The output should include the specification of:

- “Significant entities within the scope of the intended usage,
- important characteristics of the entities, including relationships between them, disambiguating characteristics, and properties important to the domain and activities within the scope of the intended usage, and
- the terminology used to denote those entities, and provide enough contextual information to disambiguate polysemous terms” (Neuhaus et al., 2013:6).

The following high-level criteria were used to evaluate the output of the Ontological Analysis Phase (Neuhaus et al., 2013:6):

- Are all relevant terms from the use cases documented?* The CFfFR is the main source document to be analysed based on the idealised assumptions (section 6.5). The relevant terms as documented in the CFfFR were documented.
- Are all entities within the scope of the ontology captured?* The scope was defined as the most fundamental classes and relationships to provide decision-useful information to the users of financial reports. Some of these fundamental classes are not documented (section 7.6.3) in the CFfFR and is an indication that the CFfFR is not complete and does not comply with the completeness requirement as determined in Chapter 4.
- Do the domain experts agree with the ontological analysis?* Some of the work has already been published in peer reviewed publications indicating some agreement from domain experts (Gerber & Gerber, 2011; Gerber, Gerber, & Van der Merwe, 2014).

- iv. *Is the documentation sufficiently unambiguous to enable a consistent use of the terminology?* Some ambiguities were detected in the source document (the CFfFR) and modeling decisions were needed to formalise the terminology. Once the terminology was formalised the ambiguities were eliminated or explained (Chapter 8).

The Ontological Analysis Phase forms the bulk of this study. Chapter 7 and a large part of Chapter 8 are devoted to the Ontological Analysis Phase. The following requirements of a global CFfFR are tested against the CFfFR during the Ontological Analysis Phase internal coherence between concepts, clear and unambiguous formulation and logical consistency.

c) **Phase 3: Ontology Design**

The Ontology Design Phase is based on the outputs from the Requirements Development Phase and the Ontological Analysis Phase. During the Ontology design Phase, representation ontology languages are chosen, design principles are determined and structural choices for the ontology are made.

Structural choices involve decisions on if and how the ontology will be separated into modules and how the modules will be integrated. The ontology of the CFfFR is not separated into different modules. It is suggested that if ontologies of accounting standards are created, each standard should be a different module.

The design principles include the determination of the top-level concepts in the domain. The design principles determine “whether and how some fundamental aspects of reality are represented (e.g., change over time)” (Neuhaus et al., 2013:7). The design principles of the ontology of the CFfFR are guided by the structure of the CFfFR as the CFfFR already provides the fundamental postulates/concepts regarding financial reporting.

The language chosen for the ontology is Web Ontology Language (OWL). The following are used in evaluating the ontology design results (Neuhaus et al., 2013:7–8):

- “Is the chosen ontology language expressive enough to capture the knowledge with sufficient detail in order to meet the ontology requirements?”
- Is the chosen query language expressive enough to formalise the competency questions?
- Does the chosen language support all required ontology capabilities?
- Is every individual or class that has been identified in the Ontological Analysis Phase either an instance or a subclass of some top-level class?
- Are naming conventions specified and, where names are provided, followed?
- Does the design call for multiple, distinct ontology modules? If so, do the ontology modules together cover the whole scope of the ontology?
- Does the design specify whether and how existing ontologies will be reused?
- Are all modules of the ontology associated with (informal) competency questions?

- For each module, is it specified what type of entities is represented in the module (the intended domain of quantification)?
- For each module, is it specified how it will be evaluated and who will be responsible?
- Does the design avoid addition of features or content not relevant to satisfactions of the requirements?"

d) Phase 4: System Design

"During system design, decisions are made that lead to requirements for the capabilities and implementation of the ontology and its integration within the larger information system" (Neuhaus et al., 2013:8). The System Design Phase is not applicable to this study but may be developed in future research to support the verification of an adapted CFfFR ontology.

e) Phase 5: Ontology Development and Reuse

The Ontology Development Phase consists of four activities: (1) informal modeling, (2) formalisation of competency questions, (3) formal modeling and (4) operational adoption. These activities follow on the Requirements Development, Ontological Analysis and Ontology Design Phases.

During informal modeling the individuals, concepts and their relationships are identified and terminology of the domain are mapped to them (Neuhaus et al., 2013). The informal modeling results are evaluated by asking the following questions (Neuhaus et al., 2013:9):

- "Does the model capture only entities within the specified scope of the ontology?"
- Are the defined classes and relationships well defined? (e.g., no formal definition of a term should use the term to define itself)
- Is the intended interpretation of the undefined individuals, classes and relationships well documented?
- Are the individuals, classes and relationships documented in a way that is easily reviewable by domain experts?"

The results of the informal modeling are used to formalise the scenarios and competency questions. The competency questions are evaluated by asking the following questions (Neuhaus et al., 2013:9):

- Is the competency questions representative for all intended usages?
- Does the formalisation capture the intent of the competency question appropriately?

During the informal modeling of the ontology, the concepts and their relationships are captured in the ontology language OWL and D.L. The result of the formal model is evaluated by determining if the "ontology represents the domain appropriately (fidelity), adheres to the design decisions made in the Ontology Design Phase

(craftsmanship), and is supposed to meet the requirements for domain representation (fitness)” (Neuhaus et al., 2013:10).⁶⁷

In order to have an operational ontology the ontology is adapted to the operational requirements during the operational adaptation activity. The concern is whether the ontology will respond in a time-frame that meets its performance requirements (Neuhaus et al., 2013). The operation adaptation activity is not important during this study as it is not part of the study to deploy the ontology.

f) Phase 6: System Development and Integration

During this Phase, the system is built and integrated with other components into subsystems as specified during the System Design Phase. This study does not include a System Development and Integrations Phase.

g) Phase 7: Deployment

During the Deployment Phase, the ontology is going to be deployed live in its intended environment. The formal domain ontology of the CFfFR will not be deployed, as it does not form part of the purpose of the ontology.

h) Phase 8: Operation and Maintenance

“This Phase focuses on the sustainment of deployed capabilities, rather than the development of new ones” (Neuhaus et al., 2013:13). As this study does not include a Deployment Phase, it also does not include an Operation and Maintenance Phase.

3.9 Knowledge Contribution and Verification

One of the key activities in DSR is the evaluation of the design artefacts and design theories “as it provides feedback for further development and ... assures the rigour of the research” (Venable, Pries-Heje, & Baskerville, 2014:1). Venable et al. (2014) developed a Framework for Evaluation in Design Science (FEDS). One of the aspects to determine is when to evaluate during a DSR project. Three points in the evaluation episodes are suggested by Venable et al. (2014).

A DSR project can be evaluated at different stages or episodes of the design process (Venable et al., 2014:Fig. 1). An *ex-ante evaluation* is a predictive evaluation to estimate and evaluate the impact of future situations. It “serves the purpose of deciding whether or not it serves the purpose of deciding whether or not to acquire or develop a technology or the purpose of deciding which of several competing technologies should be acquired or adopted. It happens before design and construction begins” (Venable et al., 2014:3). In this study, DSR Cycles 1-3 forms part of an *ex-ante evaluation* period. The artefacts or outputs form part of different evaluation episodes (Figure 3.9) during the specific evaluation strategy.

⁶⁷ Neuhaus et al. (2013) discuss fidelity, craftsmanship and fitness in detail.

An *ex post evaluation* assess the value of the implemented system (Venable et al., 2014). As the CFfFR ontology is not implemented during this study (section 3.8.3), this study does not contain an *ex post evaluation*. Evaluations can also occur *intermediately*, between an *ex-ante evaluation* and an *ex post evaluation*. The CFfFR ontology is developed in DSR Cycle 4, making the development of the CFfFR ontology artefact and the four iterations to build the artefact part of an *intermediate* evaluation episode. If the artefact outcomes of the different DSR Cycles provide satisfactory answers to the respective research questions, that specific DSR Cycle can be deemed to be successfully performed. According to the FEDS, four basic evaluation strategies that can be followed should be chosen according to four steps listed above.

The four step process of choosing and evaluation strategy according to the FEDS are: “(1) explicate the goals of the evaluation, (2) choose the evaluation strategy or strategies, (3) determine the properties to evaluate and (4) design the individual evaluation episode(s)” (Venable et al., 2014:1). The four FEDS DSR evaluation strategies are: (1) Quick & Simple, (2) Human Risk & Effectiveness, (3) Technical Risk & Efficacy and (4) Purely Technical Artefact (Figure 3.9).

The following table summarises the circumstances for selecting a relevant DSR evaluation strategy (Venable et al., 2014:6):

Table 3.5: Circumstances for selecting a DSR evaluation strategy (Venable et al., 2014)

DSR evaluation strategies	Circumstance selection criteria
Quick & Simple	If small and simple construction of design, with low social and technical risk and uncertainty
Human Risk & Effectiveness	If the major design risk is social or user oriented <i>and/or</i> If it is relatively cheap to evaluate with real users in their real context <i>and/or</i> If a critical goal of the evaluation is to rigorously establish that the utility/benefit will continue in real situations and over the long run
Technical Risk & Efficacy	If the major design risk is technically oriented <i>and/or</i> If it is prohibitively expensive to evaluate with real users and real systems in the real setting <i>and/or</i> If a critical goal of the evaluation is to rigorously establish that the utility/benefit is due to the artefact, not something else
Purely Technical Artefact	If artefact is purely technical (no social aspects) or artefact use will be well in future and not today

Venable et al. (2014) proposes two dimensions in the evaluation strategy, *why to evaluate* and *how to evaluate*.

Dimension 1: Why to evaluate – functional purpose of evaluation

The functional purpose of evaluations consists of *formative* and *summative* evaluations. The difference between formative and summative evaluations is as follows:

- “The functional purpose of *formative evaluations* is to help improve the outcomes of the process under evaluation” (Venable et al., 2014:4). With formative evaluations “meanings are validated by their consequences” (Venable et al., 2014:4).
- The functional purpose of *summative evaluations* is to judge the extent that the outcomes match expectations” and “consequences are validated by their meanings” (Venable et al., 2014:4).

The artefacts developed during the respective DSR Cycles in this study serve as evaluation points on a continuum progressing from formative towards summative functions of evaluation ending in the CFfFR ontology as a summative episode of evaluation.

Dimension 2: How to evaluate – paradigm of the evaluation study

A distinction is made between *artificial* and *naturalistic* paradigms of evaluation as the second dimension on how to evaluate a DSR project.

- An artificial evaluation, although mainly positivist and reductionist, may also use interpretive techniques to understand why an artefact works. Critical techniques may also be used to prove or disprove the design theory of DSR artefacts. “Artificial evaluation includes laboratory experiments, simulations, criteria-based analysis, theoretical arguments and mathematical proves” (Venable et al., 2014:5).
- In a *naturalistic evaluation*, the “complexities of human practice in real organisations” are involved. A naturalistic evaluation “is always empirical and tends towards interpretivism” (Venable et al., 2014:5). “Naturalistic evaluation methods typically include case studies, field studies, field experiments, surveys, ethnography, phenomenology, hermeneutic methods and action research” (Venable et al., 2014:5).

In this study, both evaluation paradigms are applicable. The building of the CFfFR tends to fall more under the artificial evaluation paradigm as it tends to be a criteria-based analysis building the artefact. The artefacts developed during DSR Cycles 1-3 fits the naturalist evaluation using hermeneutic methods of evaluation.

Both artificial and naturalistic evaluation methods can be used for formative and summative purposes. The combination of artificial and naturalistic evaluation methods with formative and summative purposes provides the relevant DSR evaluation strategies as summarised in Table 3.5.

Figure 3.9 illustrates four DSR evaluation strategies indicating the relationship between the evaluation paradigms (artificial and naturalistic) and the functional purposes (formative and summative).

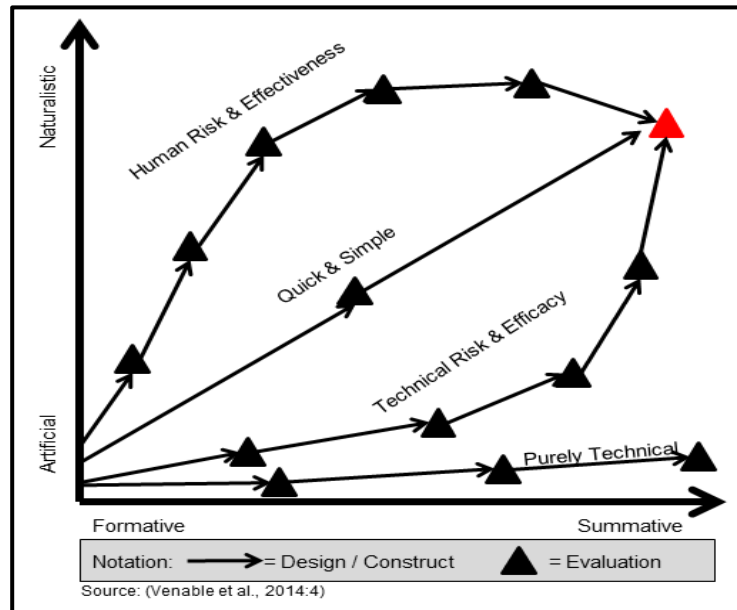


Figure 3.9: FEDS with evaluation strategies

In this study, the CFfFR ontology developed during DSR Cycle 4 is the final evaluation point (equivalent to the red triangle in Figure 3.9). The CFfFR ontology is evaluated against the competency questions posed during the development of the CFfFR ontology according to the OLC (Figure 3.8).

Taking the four-step process for choosing a DSR evaluation strategy into consideration for this study a double DSR evaluation strategy was chosen. The first strategy followed the Human Risk & Effectiveness strategy and the second strategy followed the Technical Risk & Efficacy strategy.

The Human Risk & Effectiveness strategy of evaluation is used for the artefacts developed during DSR Cycles 1-3. The design of these artefacts are socially oriented, are evaluated as social constructs and their benefits should continue in real situations. The benefits should continue if the CFfFR is considered a meta-metamodel in the financial reporting domain and the CFfFR ontology is considered as a formal domain ontology within the financial reporting ontology domain. The initial artefacts developed in DSR Cycle 1 and early in DSR Cycle 2 are more formative while the last artefacts developed in DSR Cycle 2 and those developed in DSR Cycle 3 are more summative.

The development of the CFfFR ontology, through four iterations, is evaluated from the Technical Risk & Efficacy paradigm. The major design of the artefact is technically oriented using the OLC (Figure 3.8) as design technique. The benefits of the artefact are derived from the use of the artefact in other words to determine if it is possible to get closer to the ideal and a global CFfFR by analysing the CFfFR for inherent coherence, internal consistencies, unintended meanings and completeness. The first two iterations are more formative, testing and helping to improve the outcomes of the process. The last two iterations and the accompanying artefacts are more summative, judging the extent that the outcomes would match the expectations

to answer the main research question. Figure 3.10 illustrates the double evaluation strategy followed in this study.

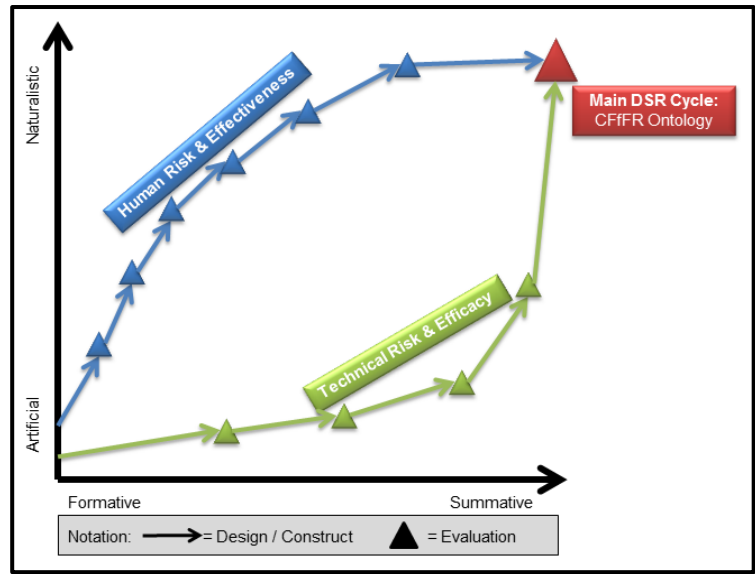


Figure 3.10: FEDS double evaluation strategy

The goal of DSR Cycle 1 is to determine the requirements and a definition of a global CFfFR that can be used as a benchmark against which the CFfFR can be measured. The valuation strategy is included in the research technique to determine the requirements that are commonly accepted in the research field from the literature. The artefact outputs (section 3.6.2) from the Development Step of DSR Cycle 1 provide answers to SRQ 1. DSR Cycle 2 finally answers SRQ 1 using model theories.

According to Mäki (2011:57) a way to characterise successful representation by a model is that “the direct examination of the model’s properties may indirectly provide information about the properties of the target”. A person learns about the target (the CFfFR) by studying the model (formal ontology of the CFfFR). A pragmatic concept of truth reveals where we can find truth in a model.

Mäki (2011:58) mentions two pragmatic properties of truth: “usefulness in regard to a purpose, and persuasiveness in regard to an audience”. Truth as usefulness in the formal ontology of the CFfFR is situated in the identification of internal incoherence’s, logical inconsistencies and unintended meanings in the natural text of the CFfFR. Truth as persuasiveness is situated in the shaping of the beliefs of the accounting community of the value of a formal ontological representation of the CFfFR. For the purpose of this study only usefulness as pragmatic property of truth is set as goal of the model. Persuasiveness of the accounting community of the value of the formal ontology of the CFfFR is not part of the truth objective of this study.

The application of the model theory of Mäki (2011; 2009; 2008) (section 5.2), and the use of models in computing (section 5.3) to determine the role of a global CFfFR serves as verification of the truth regarding the ideal role and status of the CFfFR towards providing guidance in setting globally acceptable accounting standards. The

output artefacts from DSR Cycle 2 (section 3.6.3) finally answer SRQ 1 and answer SRQ 2.

The main research question and SRQ 3 are answered during DSR Cycles 3 and 4.⁶⁸ The verification of the formal domain ontology of the CFfFR is linked to the evaluation questions mentioned during the discussion of the OLC Model (Figure 3.8). These questions are used to verify the success of the formal domain ontology. The success of the application of the ontology methodology on the CFfFR is verified by the findings on the modeling decisions, detection of unintended meanings, the indication of logical inconsistencies by the reasoner and indications of internal incoherence.

Verification of the formal ontology of the CFfFR consists of the following:

1. Evaluation of the CFfFR when building the formal ontology during the reasoning cycles, indicating internal incoherence's, logical inconsistencies and unintended meanings.
2. Providing a formal representation of the CFfFR that is inherently coherent, logically consistent and unambiguous.

The evaluation of the formal ontology of the CFfFR based upon the competency question posed for the ontology, represents the final answer to the main research question and the research project in total.

Figure 3.10 illustrates how the artefacts developed during the respective DSR Cycles (section 3.8.3) build towards the final evaluation of the CFfFR ontology.

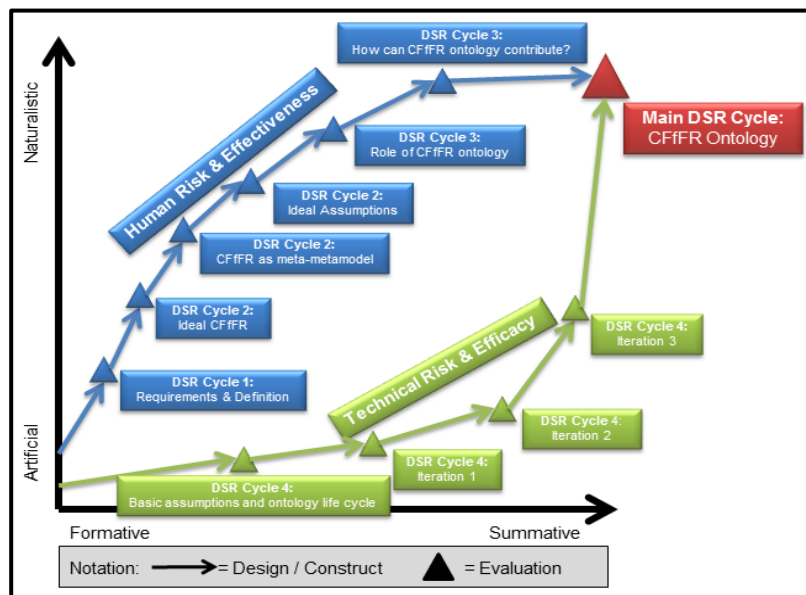


Figure 3.11: FEDS double evaluation strategy for the CFfFR ontology

In section 3.10 limitations were identified to determining the scope and applicability of the study.

⁶⁸ See Table 3.2 for an indication on how the DSR Cycles answer the respective research questions.

3.10 Limitations

The purpose and focus of this study is to set and test the requirements and role of a global CFfFR against the CFfFR with the stated purpose to provide fundamental concepts that offer a sound foundation for the development of accounting standards that are principally based, internally consistent and internationally converged.

This study does not attempt to analyse or build a theory or an ontology of the financial accounting domain. The study is focused on the analysis and testing of the existing CFfFR against certain requirements (Target *R* in Figure 5.6).

Regarding the fundamental concepts formulated in the CFfFR, this study does not intend to discuss the theoretical correctness or acceptability of the concepts by the accounting community. The study tests only the given fundamental concepts in the CFfFR for internal coherence, logical consistency and clear formulation. In cases where unintended meanings of words, concepts or definitions within the CFfFR are indicated, modeling decisions were made in order to be able to build the formal domain ontology. This study neither attempts nor proposes to provide a final or generally acceptable answer when making modeling decisions, as the decisions are primarily focused on the building of an internally coherent and logically consistent formal domain ontology of the CFfFR. The accounting community may, or may not, due to various theoretical or political reasons agree or not agree with the modeling decisions.

Regarding the definitions for the elements of the financial statements, modeling decisions are made to provide clear and unambiguous definitions for the purpose of the formal domain ontology. The proposed definitions may or may not be acceptable to the accounting community. The reasoner tests the definitions used in the formal ontology to be internally coherent and logically consistent.

Some information in the CFfFR is not modelled as it served as competency questions to inform the formalisation process. This information serves as notations explaining the classes and relationships modelled in the formal ontology. It further serves as competency questions informing on how the CFfFR ontology supports the provision of decision-useful information.

3.11 Conclusion

In conclusion, the study is designed to answer the main research question:

Main Research Question: How can a global Conceptual Framework for Financial Reporting (global CFfFR) be developed that provides fundamental concepts that are a sound foundation for the development of accounting standards that are principally based, internally consistent and internationally converged?

The research questions were answered from an interpretivist ontological stance using an abduction approach applying a DSR strategy. The main research question was answered by posing and answering three sub-research questions. The sub-research questions are:

- **SRQ 1:** What is the role, definition and requirements of a global Conceptual Framework that provides fundamental concepts for the development of accounting standards that are principally based, internally consistent and internationally converged? (SRQ1)
- **SRQ 2:** How can model building assist to construct a global Conceptual Framework that provides fundamental concepts for the development of accounting standards that are principally based, internally consistent and internationally converged? (SRQ2)
- **SRQ 3:** How can the formalisation of the CFfFR using ontologies assist to construct a global Conceptual Framework that provides fundamental concepts for the development of accounting standards that are principally based, internally consistent and internationally converged? (SRQ3)

An inductive approach using a systematic review method was used in Chapter 4 to answer most of SRQ1. The systematic review method was used to collect data from academic and other publications to determine the role, a definition and requirements of a global CFfFR. The systematic review was performed according to a systematic review protocol.

A deductive approach using an interdisciplinary investigation was used in Chapters 5 and 6 to partially answer SRQ 2. An idealised role and refinements on the requirements for a global CFfFR resulting from the systematic review were investigated. Models as isolations, idealised representations and resemblance, and truth containers as proposed by Mäki (2011) were used to position the value of the CFfFR as an ideal model to provide fundamental concepts for the development of globally acceptable accounting standards. The application and use of models and ontologies in computing in an interdisciplinary investigation were deductively used in Chapter 6 to determine the role, value and requirements of the CFfFR as a metamodel and meta-metamodel in the financial reporting domain. The application of ontologies in computing was adopted to indicate the applicability and value of ontology technologies in determining the idealised global CFfFR.

SRQ 3 was answered using an abductive approach by building a formal domain ontology of the CFfFR in Chapter 7. The internationally recognised OLC (Figure 3.8) was used as method to build and evaluate the formal domain ontology. During the building process internal coherence, logical consistency and the clarity of meanings in the natural text were tested.

During the modeling process, modeling assumptions were made. In Chapter 8 the findings of the modeling process were documented and the CFfFR was evaluated against the idealised assumptions formulated by using the modeling technique of isolation (Mäki, 2011). In Chapter 9, the contribution and suggestions for further research based on the findings were presented.

SECTION C – IMPLEMENTATION OF RESEARCH PLAN

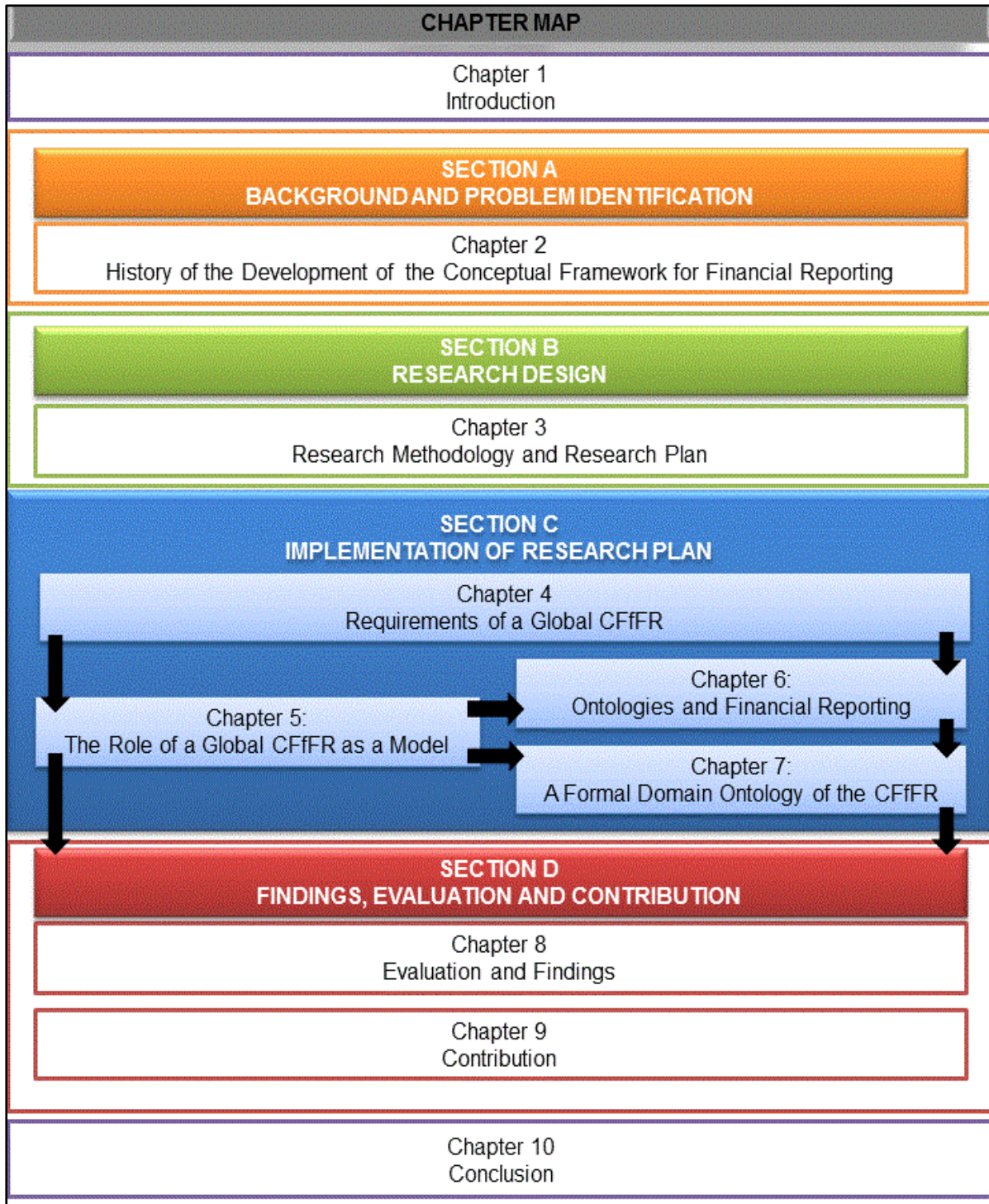


Figure 3.12: Chapter map - Section C

INTRODUCTION

In Section C, the research design provided in Section D (Chapter 3) is implemented. Section C consists of four chapters developed around answering the research problem and research questions (section 3.2).

The following are the research questions answered in Section C:

The **main research question (MRQ)**: How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

- **Sub-research Question 1 (SRQ 1)**: What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research Question 2 (SRQ 2)**: How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research Question 3 (SRQ 3)**: How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

In Chapter 4 (DSR Cycle 1) the requirements and definition for a global CFfFR is given. The requirements were determined by undertaking a systematic review of literature concerning the building of conceptual frameworks for accounting. Based on the requirements a definition for a global CFfFR was developed. The requirements are provided in section 4.6. In section 4.8, the CFfFR is tested against these requirements. By determining the definition and requirements of a global CFfFR, the first sub-research question (section 3.2) was partially answered. The role of a global CFfFR forms part of SRQ 1 and is answered during DSR Cycle 2 (Figure 5.2).

In Chapter 5 (DSR Cycle 2) the role of a global CFfFR is determined using the model theories of Mäki (2011; 2009), Kühne (2005; 2006a) and the OMG model hierarchy (OMG, 2014). During DSR Cycle 2, SRQ 1 and 2 (section 3.2) were answered. By answering SRQ 2, the theoretical foundation was established to answer SRQ 3 (section 3.2) and the main research question (section 3.2).

In Chapter 6 (DSR Cycle 3), the applicability of ontologies from the philosophical and computing disciplines to financial reporting was investigated. By determining the applicability of the use of ontologies on financial reporting, SRQ 3 (section 3.2) was answered and the study could proceed to DSR Cycle 4 (Chapter 7) in which the main research question (section 3.2) was answered by building the CFfFR ontology (Figure 7.30) and testing the CFfFR against the requirements of an ideal CFfFR.

The DSR Cycles were implemented as follows in Section C:

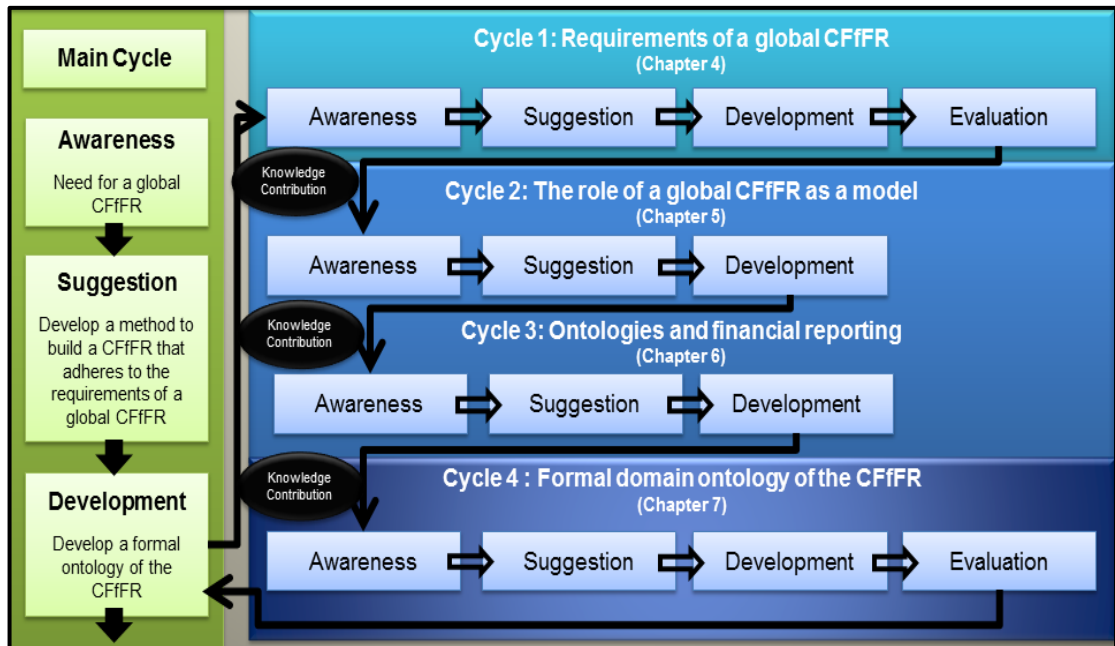


Figure 3.13: DSR strategy implemented in Section C

The matrix in the following table summarises how the DSR research strategy was implemented in Section C to answer the research questions.

Table 3.6: Matrix of research questions and DSR strategy

RESEARCH QUESTION	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
MAIN RQ	√				√
SRQ 1		√	√		
SRQ 2			√		
SRQ 3				√	√

CHAPTER 4

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4 REQUIREMENTS OF A GLOBAL CFfFR

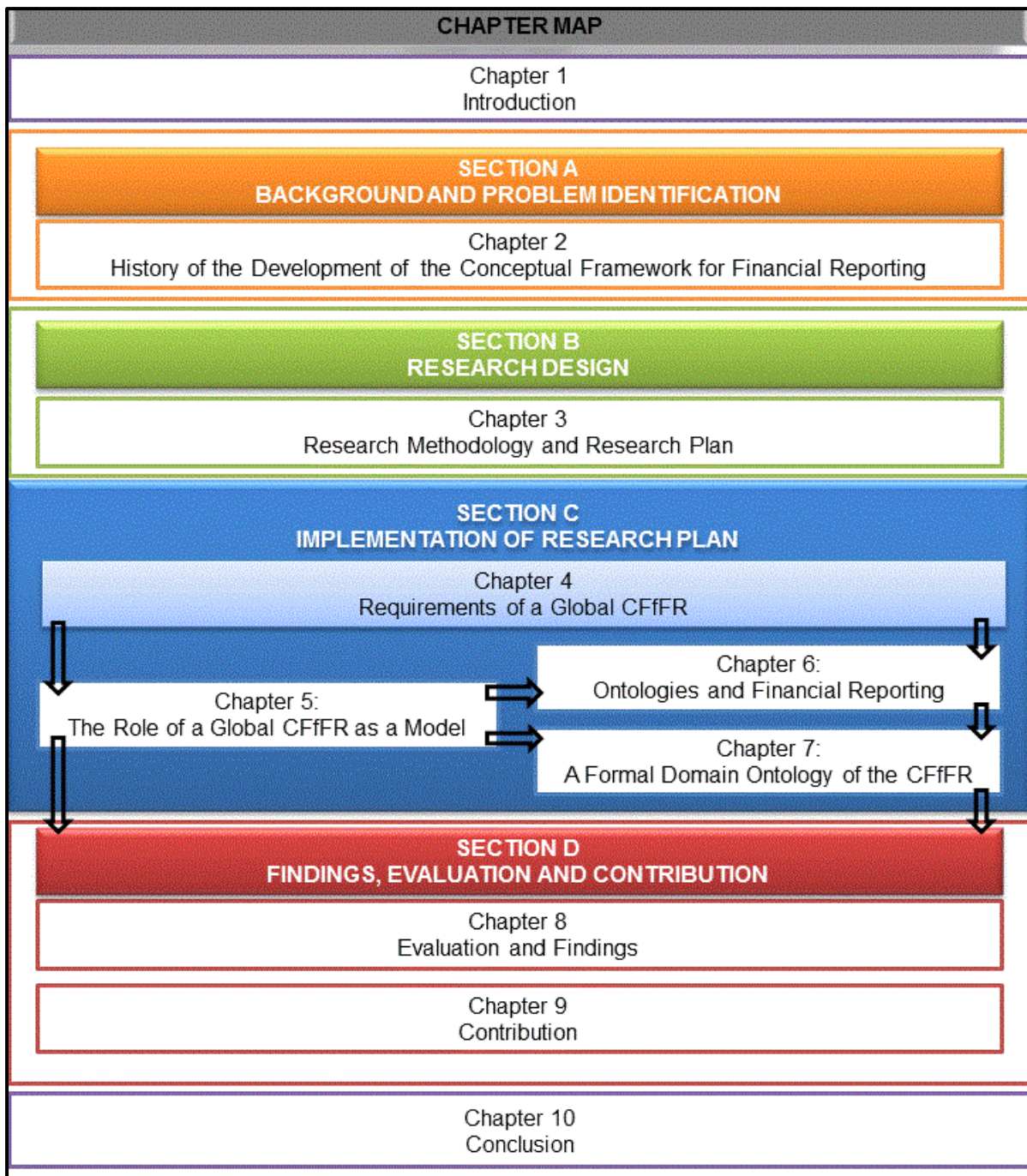


Figure 4.1: Chapter map - Chapter 4

4.1 Introduction

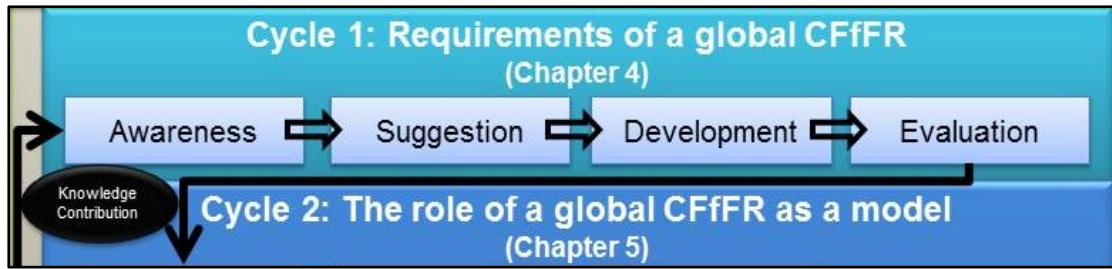


Figure 4.2: DSR Cycle 1

In Chapter 2, the historical development of the CFfFR is described as an uncompleted evolutionary process (Camfferman & Zeff, 2009; Riahi-Belkaoui, 2004; Stamp, 1980; Stamp, 1970). From the literature review, the main DSR Cycle's awareness was identified as the need for a global CFfFR (Figure 3.13) (section 3.6.1). The Awareness Step resulted in the formulation of the main research question as: how can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged? An overview of the structure of Chapter 4 is provided in Figure 4.3.

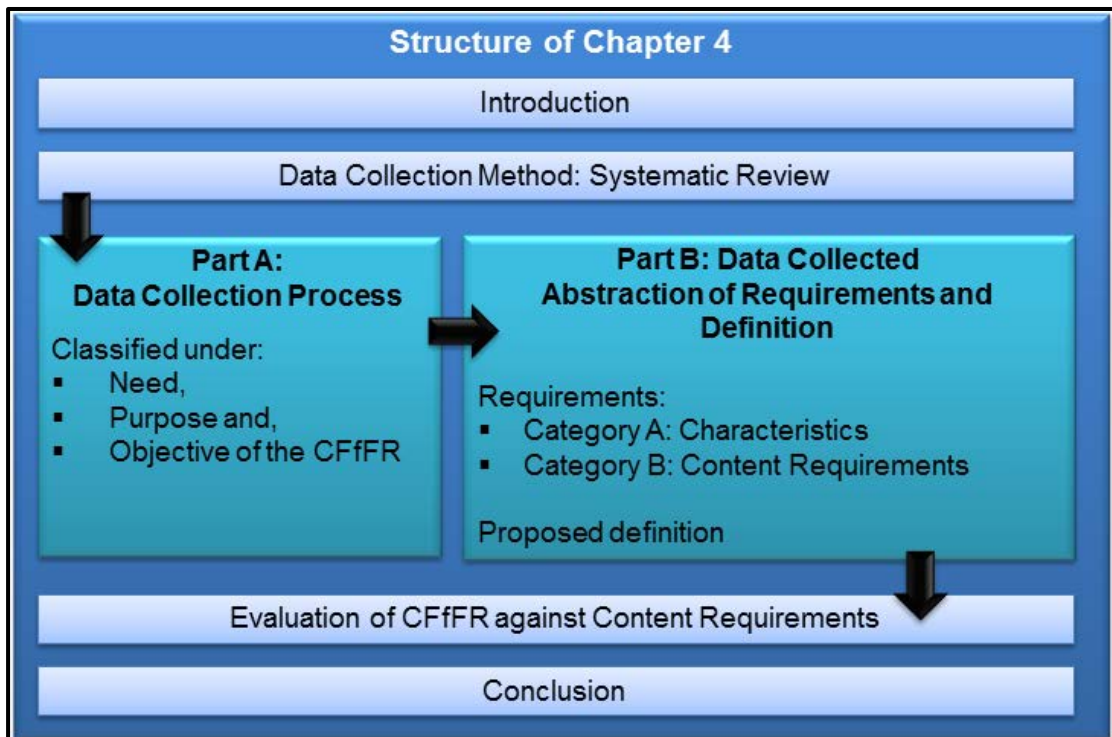


Figure 4.3: Structure of Chapter 4

The research strategy followed to answer the main research question to build a formal domain ontology of the CFfFR which adheres to more requirements of a global CFfFR than the current CFfFR, was a Design Science Research Strategy (DSR strategy), based on the discussion by Vaishnavi and Kuechler (2013) (Peffer et al., 2007; March & Storey, 2008). In the main DSR Cycle, it was *suggested* to develop a method to build a formal domain ontology of the CFfFR that adheres to the requirements of a global CFfFR (Figure 3.13) (section 3.6.1).

The first step (DSR Cycle 1, Figure 4.2) in the Development Step of the main DSR Cycle was to determine the requirements that a CFfFR have to adhere to in order to be globally acceptable. The need to determine the requirements of a global CFfFR is the Awareness Step of DSR Cycle 1 (Figure 4.2). DSR Cycle 1 partially⁶⁹ answers SRQ 1 formulated as: what are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged? The Awareness Step for DSR Cycle 1 links to the first Phase of the OLC (Figure 3.8) in which the requirements of the ontology should be developed (Vaishnavi & Kuechler, 2013).

In DSR Cycle 1, it was *suggested* to investigate literature regarding conceptual frameworks in accounting to identify requirements for a global CFfFR in order to partially answer SRQ 1. The purpose of Chapter 4, during the Development Step of DSR 1, is to determine the requirements that the CFfFR should comply with to be globally acceptable. As none of the standard setting bodies have formally formulated such requirements, the literature dealing with conceptual frameworks in accounting were analysed by performing a systematic review (section 4.2) according to the systematic review protocol (Table 4.1) to determine the requirements for a global CFfFR (section 4.6). The IASB could not provide a formal definition for the CFfFR.⁷⁰ From the literature analysed and based on the requirements identified, a proposed definition was formulated to define a global CFfFR (section 4.7).

Chapter 4, based on the execution of the systematic review protocol (Table 3.3), is structured in two Phases (Figure 4.3). During Part A, data was collected in the execution stage from the searches done according the keywords and synonyms provided in section 1.2 of the systematic review protocol (Table 3.3) and reported in sections 4.3 and 4.5.⁷¹ During the result analysis stage of the systematic review process, different need categories and the purpose of conceptual frameworks for financial reporting were identified (section 4.3). Once the data related to the need and purpose (section 4.3) and objective of a conceptual framework (section 4.5) was collected in Part A, the data was investigated to derive the requirements and definition of a global CFfFR from the data in Part B.

In Part B of Chapter 4, the outputs of the Development Step from DSR Cycle 1 are the requirements and a proposed definition of a global CFfFR (section 4.5) (or ideal CFfFR, section 5.2.4). The requirements and proposed definition are based on the need and purpose (section 4.3) and the objective (section 4.5) of a conceptual framework. The construct artefact (Table 3.1) forms part of the first evaluation step in the FEDS Human Risk & Effectiveness verification strategy.

⁶⁹ The role of a global CFfFR, also part of SRQ 1, is answered during DSR Cycle 2 (Table 3.6).

⁷⁰ The IASB was requested by email to provide a formal definition for the CFfFR. The IASB's response was to refer to the purpose of the CFfFR as formulated in the CFfFR document.

⁷¹ Chapter 4 links with Chapter 2 as it also refers to most of the material used to describe the historical development of the CFfFR, but Chapter 4 approaches the material from a different perspective. Section 4.3 is not a chronological description of the historical development of the CFfFR, but a thematic approach based on the systematic review protocol to identify the requirements and definition of a globally acceptable CFfFR.

Figure 4.4 provides a graphic illustration of the function of the first artefact developed in the FEDS Human Risk & Effectiveness verification strategy.

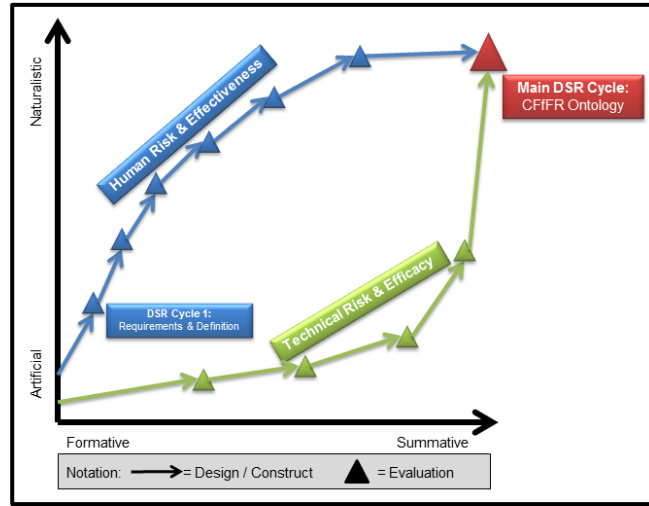


Figure 4.4: FEDS Strategy - DSR Cycle 1

In section 4.8 compliance of the CFfFR with the requirements and definition of a global CFfFR as determined in section 4.5, was evaluated. Once the CFfFR was tested against the output of the Development Step the Evaluation Step was completed and with the new knowledge obtained, the study moved over to DSR 2 in Chapter 5 (Figure 3.13 and Figure 5.2). The systematic review protocol is provided in section 4.2.

4.2 Data Collection Method: Systematic Review Protocol

In this study the systematic review protocol template suggested by Mian et al. (2005) was adopted and adapted to partially answer SRQ 1. The systematic review protocol provided in Table 4.1 was performed to determine the requirements and a proposed definition for a global CFfFR.

Table 4.1: Systematic review protocol

CONTROL	PROTOCOL
	PLANNING STAGE
3. Question formularisation: Stating the research objectives	
1.1 Question focus:	The research objective is to determine a definition and requirements for a global CFfFR.
2.2 Question quality and amplitude: • Research problem:	In a global economy the accounting community is in need of a global CFfFR to guide the setting of globally acceptable accounting standards.
• Research question:	What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged? The systematic review is focussed on answering SRQ 1 and applied during DSR Cycle 1.
• Keywords and	• Requirements of a conceptual framework;

CONTROL	PROTOCOL
<p><i>synonyms:</i></p>	<ul style="list-style-type: none"> • Definition of a conceptual framework; • Objective of a conceptual framework; • Function of a conceptual framework in accounting; • Need for a conceptual framework for accounting; • Purpose of the conceptual framework; • IASB and FASB joint project; • Development of the conceptual framework; • Postulates and principles in accounting; • Reasons and motivation for a conceptual framework • Procedures to draft a conceptual framework.
<ul style="list-style-type: none"> • <i>Intervention:</i> 	Publications discussing the definition, need, objectives and requirements of a global CFfFR to be identified.
<ul style="list-style-type: none"> • <i>Control:</i> 	During the literature review on the historical development of the CFfFR some resources dealing with the requirements and needs for a global CFfFR were identified. These resources formed a basis to start the systematic review.
<ul style="list-style-type: none"> • <i>Effect:</i> 	It is expected that discussions in the literature will be found indicating the requirements, needs, role, and definition of a global CFfFR.
<ul style="list-style-type: none"> • <i>Outcome measure:</i> 	No metrics will be applied. Sources with relevant information are studied and documented.
<ul style="list-style-type: none"> • <i>Population:</i> 	The population is observed until a stage saturation is reached.
<ul style="list-style-type: none"> • <i>Application:</i> 	Some clarity will be provided to the accounting community regarding what are perceived as the need and requirements of a global CFfFR. A definition for a global CFfFR is derived from the literature reviewed.
<ul style="list-style-type: none"> • <i>Experimental design:</i> 	No statistical analysis is applied as the information obtained is not in a statistical format. Trends in concepts and ideas regarding the need and requirements of a global CFfFR are identified and summarised.
4. Sources Selection: Sources for primary studies searches	
2.5 Sources selection criteria definition:	Conceptual frameworks and notes published by the FASB and IASB are considered to be primary sources. Important studies that preceded the development of conceptual frameworks by the FASB and the IASB are also considered but not viewed as primary sources.
<ul style="list-style-type: none"> • Studies languages: 	Primary studies are mainly obtained in English. Other languages also considered are Afrikaans, Dutch and German.
2.6 Sources identification:	
<ul style="list-style-type: none"> • Sources search methods: 	Primary documents are obtained from the websites of the FASB and the IASB. The team revising the CFfFR at the IASB is contacted via email.
<ul style="list-style-type: none"> • Search string: 	See keywords and synonyms above.
<ul style="list-style-type: none"> • Sources list: 	The following data basis and search engines are used: <ul style="list-style-type: none"> • University of Pretoria library e-resources and e-journals; • ProQuest, Accounting & Tax, Accounting; EbscoHost; Science Direct; JStor; Wiley Online Library and Google Scholar.
2.7 Sources selection after evaluation:	<ul style="list-style-type: none"> • Information regarding the function and criteria regarding a global CFfFR are evaluated.
2.8 References checking	References are checked by study supervisors when the results are presented in a written document.
3. Studies selection:	
5.7 Studies definition:	Studies dealing directly with the drafting, purpose and criteria of a conceptual framework for accounting.
<ul style="list-style-type: none"> • Studies inclusion and exclusion criteria definition: 	Inclusions: <ul style="list-style-type: none"> • Studies dealing with the theory behind and need for a global CFfFR.

CONTROL	PROTOCOL
	<ul style="list-style-type: none"> Studies dealing with critique on and problems with conceptual frameworks. Studies discussing the purpose of conceptual frameworks in accounting. Studies dealing with the motivation to draft a conceptual framework for accounting. Important studies preceding the development of the FASB and IASB conceptual frameworks. <p>Exclusions:</p> <ul style="list-style-type: none"> Studies dealing with detail on the content of conceptual frameworks for accounting. Studies not related to the conceptual framework for accounting.
<ul style="list-style-type: none"> Study types definition: 	<p>Primary sources are:</p> <ul style="list-style-type: none"> The respective conceptual frameworks published by the FASB and the IASB; Documents published by professional bodies influencing the CFFR of the IASB (see the literature review). Secondary sources dealing directly with the drafting, need and requirements of a conceptual framework or postulates and principles as it was known during the 1960s. These studies include books, e-books, peer reviewed journal papers, dissertations, reports, minutes of meetings, and web pages of organisations. Selection is a qualitative observation, based on the judgement of the researcher regarding relevance to the study and information needed at that stage.
<ul style="list-style-type: none"> Procedures for study selection: 	<p>Selection procedure for studies:</p> <ul style="list-style-type: none"> Primary resources are obtained from the different standard setting bodies. A web search is done using the keywords and search strings on the different sources identified. A first selection on web searches is done by evaluating the titles of studies. A second selection is made from the first selection judged on information in the abstract. A third selection is made from the second selection: Studies selected during the second selection stage are downloaded and evaluated by reading the introduction and conclusions of the study. Studies selected during the third selection stage are studied and relevant information is captured. Further selections based on the third and final selection. The selection cycle is repeated from the first to the third selection stages: <ul style="list-style-type: none"> The references of selected studies are scrutinised for possible relevant studies. Documents citing the selected studies are scrutinised for possible relevant additional studies. The searching cycle is repeated if new information becomes available regarding certain aspects of the study. Based on the newly required information, new search strings are developed and refined until relevant information is found. Studies selected are included in a Mendeley database.
EXECUTION STAGE	

CONTROL	PROTOCOL
5.8 Selection execution:	
<ul style="list-style-type: none"> Initial studies selection: 	556 documents, studies, reports, dissertations and web pages were initially selected and included in the Mendeley data base program.
<ul style="list-style-type: none"> Studies quality evaluation: 	The quality of the studies are evaluated and selected based on the criteria to provide information on the need, purpose and requirements of a global CFfFR.
<ul style="list-style-type: none"> Selection review: 	The final selection of 45 documents, studies, reports, dissertations and web pages is included in the references list at the end of the document.
6. Information extraction:	
6.1 Information inclusion and exclusion criteria definition:	The information is selected based on the contribution towards the clarification of the need, purpose and requirements of a global CFfFR.
6.2 Data extraction forms:	No forms are used. Information is documented and sorted as it is extracted.
6.3 Extraction execution:	
<ul style="list-style-type: none"> Objective results extraction <ul style="list-style-type: none"> Study identification Study methodology Study results Study problems 	Not applicable as this is an interpretive study - extraction is subjective based on the judgement of the researcher.
<ul style="list-style-type: none"> Subjective results extraction <ul style="list-style-type: none"> Information through authors General impressions and abstractions 	The relevant information is selected by judgement, documented and roughly sorted according to the election criteria.
6.4 Resolution of divergences among reviewers:	Does not form part of this study.
RESULT ANALYSIS	
7. Results Summarisation:	
7.1 Results statistical calculus:	Not applicable
7.2 Results presentation in tables:	<p>The documents, studies, reports, dissertations and web pages are inspected for the following categories and grouped accordingly:</p> <ul style="list-style-type: none"> Need for a global CFfFR; The objective of a conceptual framework; Requirements of a global CFfFR; Information that can contribute towards a definition for a global CFfFR. <p>The categories identified above are grouped together and then analysed for similar and conflicting trends and arguments. The different trends and arguments are colour coded and summarised to provide a summary of the arguments and trends.</p>
7.3 Sensitivity analysis:	Not applicable in this qualitative study.
7.4 Plotting:	Not applicable in this qualitative study.
7.5 Final comments	
<ul style="list-style-type: none"> Number of studies: 	A total of 45 documents, studies, reports, dissertations and web pages are used to provide the information.
<ul style="list-style-type: none"> Search, selection and extraction bias: 	As the researcher is involved in the selection, analysis and evaluation of the information the selection process can be viewed as biased. Another researcher may identify more or different needs, requirements and definitions.
<ul style="list-style-type: none"> Publication bias: 	The results need to be evaluated by a peer review process of publication.

CONTROL	PROTOCOL
<ul style="list-style-type: none"> • Inter-reviewers variation: 	The study supervisors review the results before submission for examination.
<ul style="list-style-type: none"> • Results application: 	Should the results be published via a peer review process it could contribute towards the drafting of a global CFfFR for Financial Reporting?
7.6 Recommendations	<p>It is not possible to confirm the role of a global CFfFR towards the setting of financial accounting standards from the systematic review. In the next section, the role of a conceptual framework is investigated using modeling theories from philosophy of science and computing. The two disciplines have progressed on the utilization of models for scientific research.</p> <p>Further studies are needed to either confirm or adjust the proposed definition and requirements for a global CFfFR.</p>

PART A: DATA COLLECTION PROCESS

According to the OLC Model (section 3.8.3, Figure 3.8) the first step (Phase 1, section 3.8.3a) in building an ontology is to develop the requirements of the ontology. The requirements for a global CFfFR should serve as a basis for Phase 1 of the OLC Model. As the requirements and a formal definition for a global CFfFR is not available, a systematic review was performed on literature related to accounting conceptual frameworks in an attempt to identify requirements for a globally acceptable CFfFR. These requirements could also serve as a measurement tool to evaluate the CFfFR.

The following search strings were used on the data basis indicated in section 2.2 of the systematic review protocol (Table 4.1):

- Requirements of a conceptual framework;
- Definition of a conceptual framework;
- Objective of a conceptual framework;
- Function of a conceptual framework in accounting;
- Need for a conceptual framework for accounting;
- Purpose of the conceptual framework;
- IASB and FASB joint project;
- Development of the conceptual framework;
- Postulates and principles in accounting;
- Reasons and motivation for a conceptual framework;
- Procedures to draft a conceptual framework.

During the initial selection of studies 556 documents, studies, reports, dissertations and web pages were selected. A circular procedure was followed in selecting the studies. The selection process went through three selection stages. Once the selected works were scrutinised the relevant material were selected. As the works were studied and new information became available, a new search cycle was done to explore the possibilities of the new information. After a review of these documents, 45 documents were used to identify the requirements.

The information obtained from the documents were categorised and grouped according to themes. The themes were chosen based on the possibility to identify

requirements for a global CFfFR. The information contributing towards identifying requirements for a globally acceptable CFfFR were grouped under the following themes:

- The need of a conceptual framework;
- The purpose of a conceptual framework;
- The objective of a conceptual framework.

Although in principle the need for a conceptual framework was indicated during the discussion on the evolutionary development of the CFfFR in Chapter 2, the foundation for the development of a conceptual framework was laid during an active search for the basic postulates and principles for accounting in the 1960s (Zeff, 1982). Some of the most basic requirements were developed during this period. Two broad themes arguing around the reasons for a conceptual framework for accounting were identified. For the purpose of this study they are classified under practical and political reasons (section 4.3.2) and functional and technical reasons (section 4.3.3).

Two other themes related to the identification and motivation of some requirements for a global CFfFR are the teleological principles (section 4.3.4) used in the CFfFR and discussions regarding the pedagogic, provision of information and justification function of a conceptual framework (section 4.3.5). After the general literature was analysed, the focus of the search of requirements shifted to two influential conceptual frameworks, the FASB conceptual framework and the IASB CFfFR. The need for a FASB according to the FASB conceptual framework itself was analysed (section 4.3.6). The purpose of conceptual frameworks was obtained directly from the FASB conceptual framework (section 4.4.1) and the IASB CFfFR (section 4.4.2).

Some requirements, needed to build the formal domain ontology of the CFfFR, were identified during the investigation of the objective for a conceptual framework (section 4.5). The objective of the CFfFR was identified as the main competency question to be answered by the formal domain ontology of the CFfFR.

Based on the analysis of the data gathered during Phase A of Chapter 4, the requirements for global CFfFR were formulated in Phase B of Chapter 4.

4.3 The Need for a Conceptual Framework in a Global Economy

The economic globalisation can be viewed as the main stimulus for the search for one set of global financial standards. This was confirmed by Mackintosh (2014:5) during his address as Vice-Chairman of the IASB at a function of SAICA on 13 August 2014 when he concluded with "I have offered my views on how economic globalisation created the need for global accounting standards. How the continued melding of national capital markets into one big, globally interconnected market presents a compelling case for a global language of financial reporting". The need for a global CFfFR is closely linked to the need for global accounting standards. This link and the need for a global CFfFR are provided in sections 4.3.1- 4.3.6.

4.3.1 Foundation for the Development of the CFfFR – 1960s

From the discussion on the history of the development of the CFfFR (Chapter 2) the conclusion can be made that accounting as discipline has mainly developed from the early ages as a “response to practical needs rather than by deliberate and systematic thinking” (Chambers, 1963:3). The idea of a conceptual framework in accounting evolved through a needs system of stimulus and response (Salvary, 1979). The first efforts to systematise accounting were documented in the 13th century with the works of Benedetto Cotrugili – *Della Mercatura e del Mircanti Perfectto Della Mercautra* in 1458 and Luca Pacioli – *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* in 1494 (Table 2.3).

According to Zeff (1999) the monograph of Paton and Littleton in 1940, *An Introduction to Corporate Accounting Standards* (Table 2.1), influenced by *A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements* of the AAA, was the first institutional effort in the U.S. to develop a conceptual framework for business enterprises. The search for accounting postulates and principles during the 1960s (Zeff, 1982) laid the foundation for the development of conceptual frameworks after the formation of the FASB and the IASB in 1973.

The need for a globally acceptable conceptual framework and global accounting standards increased as the global markets developed (Zeff, 2012). Commissioner Stein (Stein, 2015) of the SEC confirms the ideal of a single set of globally-recognized, high-quality accounting standards. During the systematic review of literature regarding the development of conceptual frameworks in accounting, the focus was to determine why conceptual frameworks are demanded by the accounting community and then in reaction to the demand, drafted by standard setting bodies.

4.3.2 Practical and Political Reasons

The various needs for a conceptual framework for accounting as identified in the literature can be classified into mainly two categories. The first need category can be described as *practical and political* reasons to legitimise accounting standards (Alexander, Le Manh-Béna, & Ramond, 2013; Hines, 1989). The second need category can be classified as *functional and technical* reasons (Moonitz, 1963; Chambers, 1963) based on a theoretical perspective for setting a conceptual framework.

The practical and political category relates to the response of the accounting profession to financial disasters on the economic front (the Great Depression of 1929) and the drive to obtain credibility from the accounting profession (Alexander et al., 2013; Hines, 1989). The drive to obtain credibility can be linked to the introduction of regulation by means of legislation (section 2.6).

a) **Financial disasters**

In reaction to economic disasters and enforced legislation, the accounting profession formulated rules and recommendations on an ad hoc basis to provide guidance to accountants (Storey & Storey, 1998).⁷² The emergence of principle based accounting can be attributed to the economic crises between 1844 -1937 (Hoffmann & Detzen, 2013).

The Railway Mania during 1845 -1847 stimulated an improvement in the disclosure levels of the financial reports (McCartney & Arnold, 2003; Odlyzko, 2012; Bryer, 1991; McCartney & Arnold, 2010; Arnold & McCartney, 2002) (section 2.5.1). Both the quantity and quality of the information disclosed improved. The conceptual basis of reporting changed “from a cash to an accrual basis” (McCartney & Arnold, 2010:401) and the standardisation of depreciation treatment was developed. These changes still happened in what is called a *laissez-faire* (unregulated) system of financial regulation (Hoffmann & Detzen, 2013).

The Great Depression, starting with the Wall Street Crash on 24 October 1929 ending in 1933, introduced the beginning of a more regulated system with the establishment of the SEC in 1934. These financial disasters directly caused the search for accounting theories. In reaction to the Great Depression two important documents regarding accounting principles were published, “*A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements*” (American Accounting Association, 1936) and the “*Statement of Accounting Principles*” by Sanders, Hatfield and Moore (Gaffikin, 2008; Storey & Storey, 1998). From 1938 to 1973, professional bodies mainly summarised accounting practices without a theoretical basis and reacted on an ad hoc basis to the requirements of the SEC (section 2.5.2, Table 2.3). The importance of a theoretical basis is emphasised by the replacement of the APB due to the lack of developing accounting principles. From 1960 to 1973 a lot of discussion on accounting postulates and principles were conducted (Zeff, 1982).

Since 1973, one of the most prominent financial crises was what is today known as the subprime loan crisis. On September 26, 2008, failures of large financial institutions in the U.S. developed into a global crisis resulting in bank failures and sharp reductions in equity values in Europe (Appendix C). This crisis started in the summer of 2007 when U.S. subprime losses triggered disruption in the global financial system (Deloitte., 2015). The subprime loan crisis emphasised the interconnected nature of capital markets (Mackintosh, 2014) and underlined the need for global accounting standards. The importance of the financial crises for accounting standard setting is emphasised by a hit of 2 400 results when a search for the term “financial crisis” is conducted on the IASB web site (IASB, 2015a). A Financial Crisis Advisory Group (FCAG) was formed to “consider how improvements in financial reporting could help enhance investor confidence in financial markets” (IASB,

⁷² Alexander et al. (2013:3–6) provides a short description of the emergence of a conceptual framework in the United States and conceptual framework projects in countries with an Anglo-American accounting tradition.

2015b:1) after the subprime crisis. The following are some of the issues dealt with by the FCAG:

- “Areas where financial reporting helped identify issues of concern, or created unnecessary concerns, during the credit crisis.
- Areas where financial reporting standards could have provided more transparency to help either anticipate the crisis or respond to the crisis more quickly.
- Whether priorities for the IASB and the FASB should be reconsidered in light of the credit crisis.
- Potential areas that require future attention of the IASB and the FASB in order to avoid future market disruption.
- The implications of the credit crisis for the interaction between general-purpose financial reporting requirements for capital markets and the regulatory reporting, particularly for financial institutions.
- The relationship between fair value and off-balance sheet accounting and the current crisis, both during and leading up to the crisis.
- The findings and relevance of conclusions of various studies underway, including the US Securities and Exchange Commission study under the Emergency Economic Stabilization Act of 2008.
- The need for a due process for accounting standard-setters and its implications on resolving emergency issues on a timely and inclusive basis.
- The independence of accounting standard-setters and governmental actions to the global financial crisis” (IASB, 2015b:1).

Three round tables (Asia, Europe and North America) were organised by the IASB and the FASB on the global crisis.⁷³ A direct result of the subprime crisis was the elevation of the revision of IAS 39 being replaced by IFRS 9 *Financial Instruments* (IASB, 2015c). IFRS 9 is described by the IASB (2015c:1) as a “comprehensive response to the financial crisis”.

It is difficult to prove a direct link between the effect of the subprime loan crisis and the development of the CFfFR. The development of the CFfFR is influenced by the subprime loan crisis in two possible ways. Firstly, the subprime crisis could indirectly

⁷³ On November 14 2008, the first round-table was held in London.

be responsible for the suspension of the joint conceptual framework project between the FASB and the IASB. Both the IASB and the FASB had financial reporting crises on hand to manage as is evident from the steps implemented by the IASB (and the FASB) to manage the crisis. On a Joint Board Meeting of the FASB and the IASB on November 19, 2010 regarding the Conceptual Framework project, “because of the priority placed on other projects, the Boards concluded that they cannot devote the time necessary to properly address those issues in the near future” (FASB and IASB, 2010:1). Secondly, the developments on individual standards after the subprime crises feed back into the revision of the CFFR as it has been taken into account as the CFFR is being revised (IASB, 2013a).

The subprime crisis could be seen as a stimulus in the stimulus/response process of the development of the CFFR, which corresponds with the effect of the previous major crisis, the Great Depression, which served as a major stimulus to search for accounting postulates and principles.

b) *Legitimacy and credibility*

According to Hines (1989), perceived from a social constructivist perspective the major reason for the development of conceptual framework projects by standard setting bodies is to provide legitimacy to their accounting standards and not due to functional or technical considerations. The discussion on the history of the CFFR supports the social constructivist theory of Hines (1989) (see sections 2.6, 2.7 and 2.8). In support of Hines’ (1989) perspective, the IASC only started its conceptual framework project after it was criticized for not having an explicit or implicit framework of objectives for setting accounting standards (Alexander et al., 2013; Zeff, 2012). In the case of the AICPA it was a survival strategy not to let the SEC take over the standard setting process (Alexander et al., 2013).

Alexander et al. (2013:7) agrees in principle with Hines (1989) stating the motives of privately regulated standard-setting bodies to develop a conceptual framework “is not necessarily intended to have operating effects but is rather crucial, from a political stand point”. The motive for a private standard-setter is to maintain professional power when its legitimacy is questioned (Power, 1992) or “when the credibility of financial reporting standards are in doubt” (Alexander et al., 2013:7).

Legitimacy and credibility can be obtained by various means. An important aspect in the acceptance of a conceptual framework and accounting standards is the degree of representativeness when a conceptual framework or an accounting standard is drafted (Alexander et al., 2013; Hines, 1988; Peasnell, 1982; Power, 1992; Stamp, 1980). According to Peasnell (1982:254) for a standard setting body to obtain credibility it needs “to demonstrate that it is trying by logical means to develop accounting standards based on principles of general appeal”.

The degree of credibility required by a standard setting body differs depending on its level of independent status. In cases where accounting standards do not have to be approved by a statutory body, that standard setting body needs a higher degree of credibility to obtain legitimacy (Alexander et al., 2013). When both the responsibility

and power of developing accounting standards are situated within one body, the need for a conceptual framework by that body is essential in order to obtain credibility (Alexander et al., 2013; Peasnell, 1982). In the case of the FASB, the approval by the SEC of the accounting standards set by the FASB provides credibility to the accounting standards.

In the case of the IASB, there is no statutory body approving its accounting standards. Because of its independence, the IASB's political credibility is weak and a conceptual framework is the best way to show that its accounting standards are developed "in a fair, logical and highly professional manner" (Alexander et al., 2013:8). According to Burlaud and Colasse (2011:23) the credibility of the IASB's accounting standards are founded on procedural and substantial legitimacies.

The search for procedural legitimacy and credibility involves the composition of the IASB members and the members' independence, competencies and transparency regarding the due process to draw accounting standards. The due process followed by the IASB to draw up financial statements intends to enhance transparency and to ensure that parties concerned can be involved in the standard setting process and have an opportunity to make their views clear (Burlaud & Colasse, 2011).

The due process is published on the IASB's website in a document entitled "How we consult: Encouraging broad participation in the development of IFRS" signed by Sir David Tweedie (IASB, 2010c:3). See Figure 4.5: IASB Due process to develop below for a schematic illustration of the due process. Apart from publishing the due process and inviting interested parties to participate in the accounting setting process, the IASB also uses advisory bodies to strengthen its procedural legitimacy (IASB, 2012c).

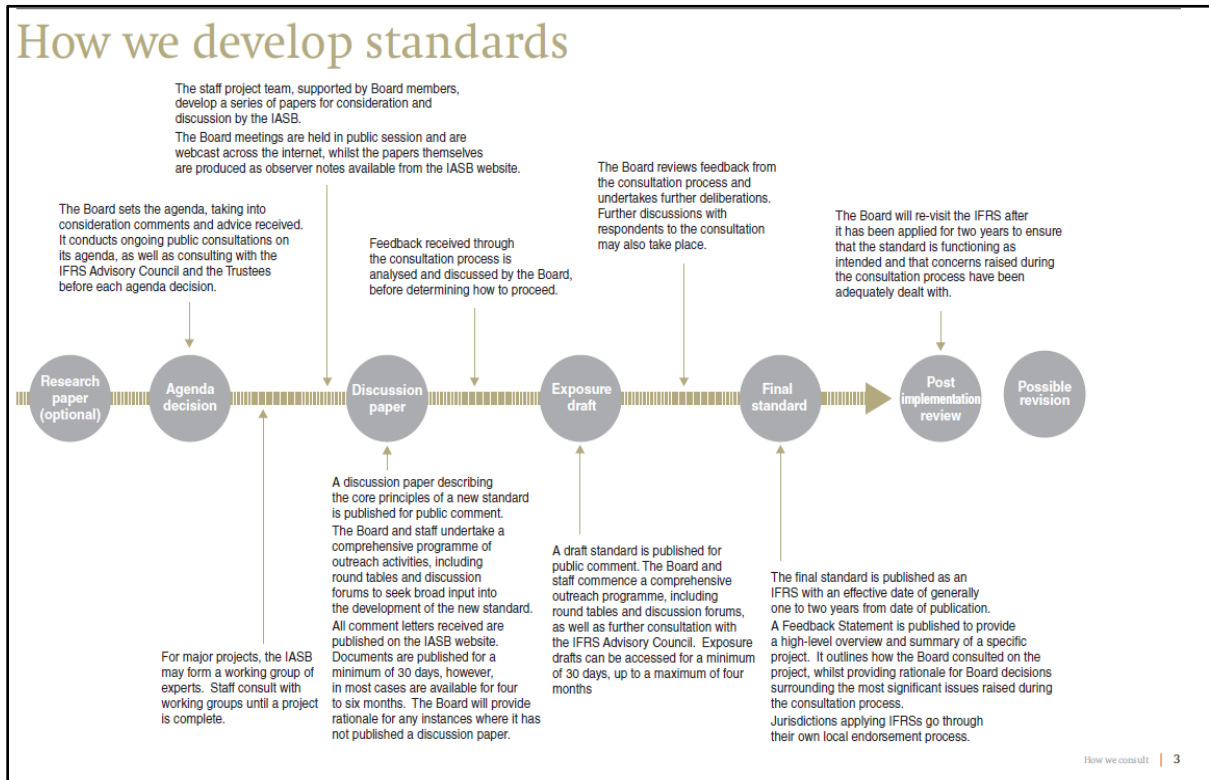


Figure 4.5: IASB Due process to develop IFRS's (Copied from the IASB document: "How we consult: Encouraging broad participation in the development of IFRS")

The IASB's search for substantial legitimacy is linked to its use of the CFfFR (Burlaud & Colasse, 2011), using technical teams to perform research on topics, having outreach programmes, round tables and discussion forums as well as consultation with the IFRS Advisory Council (IASB, 2010c).

c) **Rational ground for a conceptual framework**

The rational ground of drafting a conceptual framework according to Alexander et al. (2013) is that a conceptual framework would assist in the internal consistency of accounting standards based on the conceptual framework. In reality, conceptual frameworks were created in respect to technical failures and shortcomings in the standard setting process. Practical and institutional aspects often played a decisive role and it comes down to a trade-off between politics and practical considerations when the decision is made to draft a conceptual framework (Alexander et al., 2013).

The discussion above related to the practical and political category clearly states that the accounting profession and legal authorities accept that a conceptual framework contributes towards the acceptance of accounting standards, hence the need for a conceptual framework. However, the discussion does not answer why the phenomenon of a conceptual framework contributes towards the acceptance of accounting standards. Regardless of the reasons why the accounting profession drafted various conceptual frameworks since the first attempt by the AAA in 1936, the actions taken by the FASB and the IASB confirm that there is a definite, more theoretically motivated need for a globally acceptable conceptual framework in the accounting profession.

4.3.3 Functional and Technical Reasons

The functional and technical needs category provides some answers as to why a conceptual framework is needed, other than just to provide practical or political legitimacy to a standard setting board. The functional and technical need relates to dissatisfaction within the accounting community (standard setters, academics and practitioners). According to Persson and Napier (2013) and Storey and Storey (1998) the accounting community were dissatisfied with the piecemeal approach of setting accounting standards in the late 1950's without a frame of reference. Chambers (1963:4) stated in 1963 that the rules and recommendations formulated until that stage “exhibit indeterminacies, divergences and inconsistencies” and that some “rigorous and extensive examination of accounting is necessary”. Stamp (1970; 1980) confirms that empirical research is necessary and that a conceptual framework should be constructed for the establishment of accounting principles.

A direct result of the dissatisfaction of the piecemeal approach by the AICPA was the establishment of the ARD to research the establishment of accounting postulates and principles (Storey & Storey, 1998; Wolk et al., 2013). The result of the research conducted by the ARD was the publication of ARS 1 (Moonitz, 1982) and ARS 3 (Sprouse & Moonitz, 1982) in 1961 and 1962 respectively. The purpose of ARS 1 was to provide basic accounting postulates and ARS 3 had to derive accounting principles from these postulates. According to Persson and Napier (2013) the reaction on ARS 1 and ARS 3 was negative as it was perceived to be too divergent from the accounting practices at that time.

The need for postulates and principles as a basis of reference for setting accounting standards was, amongst others, argued from a functional and technical perspective by two respectable accounting thinkers during the 1960s, i.e. Maurice Moonitz (1963) and Raymond J. Chambers (1963).

a) *Technical and theoretical reasons by Moonitz*

According to Moonitz (1963:46) postulates and principles are needed for the following technical and theoretical reasons:

1. Postulates and principles provide accounting with a frame of reference for solving issues in specific problems. The notion of a “consistent framework of standards ... as basis for judgement in constructing and interpreting financial statements” was already mentioned by Vance (1944:231).
2. With the help from logic, postulates and principles help to explain why certain procedures are acceptable and others are not.
3. Postulates and principles provide a “basis for extensions into new and untried areas with assurance that extensions are sensible and in harmony with the larger framework of accounting” (Moonitz, 1963:46).
4. Postulates and principles should narrow the areas of difference and inconsistencies in practice.
5. Postulates and principles help to form a consistent whole.
6. Postulates and principles form part of the process of knowledge development in accounting.

b) *Epistemological perspective by Chambers*

Chambers (1963) argues for the setting of accounting postulates and principles from a more epistemological perspective. According to Chambers (1963:15) accounting needs postulates because:

1. "Every deliberate action of reasonable men, ... is based on some postulates and reasonable men always want to be sure of their ground";
2. To re-examine the foundation of one's practices is common wisdom because practices may become habitual and conventional trappings and lose their original purpose. Gore and Zimmerman (2007:30) agree with Chambers when they state that the revision of the conceptual framework "will involve the examination of the foundations of financial reporting and, indeed, accounting itself."
3. "A man's postulates are the substance of his understanding of the world" and a person's practices lose merit from his fellows if his postulates are irrelevant or inconsistent;
4. The examination of one's postulates and principles are the "simplest and most effective way" to improve and innovate practices;
5. "Man's reasoned judgement is his only protection against self-delusion, cant and deceit."

The motivations from Moonitz (1963) and Chambers (1963) to search for accounting postulates and principles were part of the motivation and drive in the 1960s to search for accounting postulates and principles. Although the accounting profession did not accept the postulates and principles presented in ARS 1 and ARS 3 as being useful for financial reporting practices, the need for a basis of reference for setting accounting standards was still alive.

The need for a conceptual framework is evident from the publication of numerous conceptual frameworks or frames of reference from different constituencies from the 1960s onwards. Following is a list of frames of references as provided by Zeff (2013) in his presentation to the ICAEW in December 2012.

From the U.S.:

- 1966 – ASOBAT by the AAA
- 1970 – Statement No. 4 by the APB
- 1973 – Trueblood Report by AICPA
- 1978 – Statement of Financial Accounting Concepts No. 1 by the FASB

From Great Britain:

- 1975 - The Corporate Report by the ASSC
- 1988 – Making Corporate Reports Valuable by the ICAS
- 1989 – Guidelines for Financial Reporting Standards by David Solomon
- 1999 – Statement of Principles for Financial Reporting by the ASB

From Canada:

- 1980 – Corporate Reporting: Its Future Evolution by Edward Stamp (1980)
- 1987 – Conceptual framework by the ASAC
- 1988 – Financial accounting concepts by the AcSC

From Australia:

- 1990 – Statement of Accounting Concepts 2

After the various attempts listed above, the next step was to search for a conceptual framework that was globally acceptable. With the globalisation of the economy, the need for a globally acceptable basis for setting accounting standards was formalised with the Norwalk Agreement (FASB and IASB, 2002).

Whittington (2008b:498) formulated the need for a globally acceptable conceptual framework as follows: “Clearly, a globally acceptable conceptual framework is a necessary pre-requisite for globally acceptable standards”. The implication of the remark is that a conceptual framework should serve as a basis of agreed upon shared knowledge to set accounting standards and is in agreement with reason No. 1 of Moonitz above.

The results of the search for a globally acceptable conceptual framework and on an international level are (Zeff et al., 2013):

- 1989 – Framework by the IASC;
- 2010 – Objective of General Purpose Financial Reporting jointly by the IASB and FASB.

4.3.4 Teleological Principle

Another important principle contributing to the need for a conceptual framework is based on the teleological principle⁷⁴ fundamental to the Roman law system (Alexander et al., 2013). According to Alexander et al. (2013) the relationship of the CFfFR to the IFRS standards is in accordance with the teleological principle. The Greek noun Τέλος is used in Koine Greek⁷⁵ in the following semantic domains (Louw, Nida, Smith, & Munson, 1989):

- Semantic domain 67.66 - end, “time a point of time marking the end of a duration” (Louw et al., 1989:638);
- Semantic domain 89.40 - result, “the result of an event or process, with special focus upon the final state or condition; relationships” (Louw et al., 1989:782);
- Semantic domain 89.55 - purpose, “the purpose of an event or state, viewed in terms of its result” (Louw et al., 1989:784);
- Semantic domain 78.47 - completely, “a degree of completeness, with the possible implication of purpose or result” (Louw et al., 1989:692);
- Semantic domain 57.179 – tax, “payments customarily due a governmental authority” (Louw et al., 1989:578).

The teleological principle referred to by Alexander et al. (2013) falls within the use of Τέλος as indicated in semantic domain 89.55. The teleological relationship between

⁷⁴ **Teleology**, (from Greek *telos*, “end” and *logos*, “reason”), explanation by reference to some purpose, end, goal or function. Traditionally, it was also described as final causality, in contrast with explanation solely in terms of efficient causes (the origin of a change or a state of rest in something) (Abdullah, Anderson, Anderson, Augustyn, Barton, et al., 2015).

⁷⁵ Also known as Hellenistic Greek or the Alexandrian dialect of Greek spoken during Hellenistic and Roman antiquity.

the CFfFR and IFRS's is that the CFfFR has the purpose of an event or state (the provision of guidelines) is viewed in terms of its result (decision-useful information). The purpose of the CFfFR is the provision of fundamental concepts and relationships guiding the IFRS standards. According to the purpose and status of the CFfFR (IASB, 2010a:A19) the "*Conceptual Framework* sets out the concepts that underlie the preparation and presentation of financial statements for external users". Another implication of the teleological principle is that the CFfFR is considered as extraneous material to the IFRS's to interpret the IFRS's whenever there is any ambiguity in the IFRS's (Alexander et al., 2013). According to the intended use of the CFfFR as indicated in section 4.3.3b) as well as the purpose and status of the CFfFR, the teleological relationship between the CFfFR and the IFRS's is confirmed.

A consequence of the teleological relationship between the CFfFR and the IFRS's is that the CFfFR should be unambiguous (without unintended meanings) in order to clarify ambiguities in the IFRS's. If the CFfFR is to serve as extraneous material to clarify ambiguities in the IFRS's, then the CFfFR itself should be without ambiguities. Apart from the teleological relationship between the CFfFR and the IFRS's, the following three functions of accounting theories also contributes towards motivating the requirements for a global CFfFR.

4.3.5 Pedagogic, Information and Justification Functions

Watts and Zimmerman (1979) summarizes the demand of accounting theories in an unregulated economy according into three functions i.e. a pedagogic function, information function and a justification function.

The justification function is formulated by Watts and Zimmerman (1979:285) as follows: "...accounting theory should be used to determine accounting practice and standards". It provides the theoretical framework and guidance to distinguish between different accounting practices and interpretations (DePree, 1989). A conceptual framework also serves as a body of shared knowledge bringing together the results of research and experience at a specific time i.e. the information function. A conceptual framework should also serve as basis for further research to enhance the field of accounting i.e. the pedagogic function.

Considering the pedagogic function, information function and a justification function of Watts and Zimmerman (1979) and the teleological principle described by Alexander et al. (2013) the theoretical motivation by Moonitz (1963) and Chambers (1963) for drafting postulates and principles in the 1960s are still valid for drafting a conceptual framework. The demand for accounting theories for a conceptual framework according to Watts and Zimmerman (1979) is not limited only to accounting standard bodies providing support in setting accounting standards.

The practical and political needs for a conceptual framework to support the legitimising efforts of standard setters are rooted in the theoretical, functional and technical reasons for a conceptual framework. The implication is that the more theoretically and technically sound a conceptual framework is, the easier the legitimising process is.

4.3.6 Need According to FASB

When the focus is shifted to the standard setting bodies themselves it is clear that they value the need and purpose of a conceptual framework as more than only a legitimising function.

The FASAC (2004:2) motivated the need for a conceptual framework as follows:

“The FASB developed its conceptual framework because it concluded that its decisions should be soundly grounded in a unified set of concepts. The board’s mission cannot be fulfilled without a conceptual underpinning that provides direction and the means for deciding whether one solution to a financial reporting issue is better than the others. A conceptual framework provides the unity that is required, and with that, the direction and means to help in making those decisions. Without a set of unified concepts, standard setters are like a ship in a storm without an anchor.”

The FASAC (2004) noted the following reasons in 2004 to revisit the Framework:

- The current framework is out-dated. At the time when it was decided to revise the FASB framework, it was already more than 20 years old. The dynamic nature of accounting was illustrated in the stimulus/response pattern of development of accounting in sections 2.2 to 2;
- Inconsistencies in the framework need to be eliminated;
- Some planned parts were not completed. There is a lack of guidance in these areas;
 - The result of the lack of guidance is:
 - Board members use their own internal conceptual frameworks.
 - Decisions are not durable and are susceptible to change with the change of board members.
 - The framework is becoming less helpful in providing guidance to board members.
- The board’s decision to produce principles-based standards added to the need to revisit the framework;
 - Principles-based standards by nature should be based on a coherent and cohesive set of concepts i.e. a conceptual framework that is;
 - up to date,
 - internally consistent and,
 - comprehensive.
- The SEC supports principles-based standards that are drafted “in accordance with the objectives set by an overarching, coherent framework meant to unify the accounting system as a whole” (FASAC, 2004:7).

The purpose of a conceptual framework for financial reporting as formulated in the FASB conceptual framework and the IASB CFfFR provide clarity on some requirements for a global CFfFR.

4.4 The Purpose of a Conceptual Framework for Financial Reporting

4.4.1 The Purpose According to the FASB Conceptual Framework

The purpose of the FASB conceptual framework is to formulate the objectives and fundamental concepts forming the basis for the development of financial accounting standards (FASAC, 2004; FASB, 2010a). Other concepts flow from the fundamental concepts and refer to them (FASB, 2010a). In order to achieve the purpose of the conceptual framework forming the basis for the development of financial accounting standards, the fundamental concepts formulated in the conceptual framework should adhere to at least the following:

- the fundamental concepts should be clearly formulated and inherently consistent (FASAC, 2004);
- the level of abstraction should cover all known transactions, events and conditions i.e. it should be complete (FASB, 2010a);
- selection criteria should be formulated (qualitative criteria) unambiguously (FASAC, 2004; FASB, 2010a);
- the fundamental concepts should enable the selection of transactions, events and conditions to be reported (FASB, 2010a);
- the fundamental concepts should enable the recognition and measurement of the selected transaction (FASB, 2010a);
- the fundamental concepts should guide the summary and communication of selected transactions (FASB, 2010a).

According to the FASB the purpose of a conceptual framework is to provide consistent guidance to standard setters and provide “structure and direction to financial accounting and reporting to facilitate the provision of unbiased financial and related information” (FASB, 2010a:iv).

4.4.2 The Purpose of the CFfFR According to IASB

The purpose of the CFfFR refers to six users and seven uses of the CFfFR (IASB, 2010a). The intended users are the Board of the IASB, national standard setters, preparers of financial statements, auditors, users of financial statements and any other interested parties.⁷⁶ The IASB had a very broad audience in mind as the intended users of the CFfFR, contributing to the substantial legitimacy of the accounting standards.

According to the CFfFR, it is intended to be used:

- a) “to assist the board in the development of future IFRS’s and in its review of existing IFRS’s;

⁷⁶ During the revision process of the CFfFR the staff of the IASB recommends that the purpose of the CFfFR should identify the concepts that:

“(a) assist the IASB to develop and revise ‘FRS’s;

(b) assist preparers to develop accounting policies when no IFRS applies to a particular transaction, event or condition.

(c) assist all parties to understand and interpret IFRS’s (IASB, 2014b).

- b) to assist the board in promoting harmonisation of regulations, accounting standards and procedures relating to the presentation of financial statements by providing a basis for reducing the number of alternative accounting treatments permitted by IFRS's;
- c) to assist national standard-setting bodies in developing national standards;
- d) to assist preparers of financial statements in applying IFRS's and in dealing with topics that have yet to form the subject of an IFRS;
- e) to assist auditors in forming an opinion on whether financial statements comply with IFRS's;
- f) to assist users of financial statements in interpreting the information contained in financial statements prepared in compliance with IFRS's; and
- g) to provide those who are interested in the work of the IASB with information about its approach to the formulation of IFRS's" (IASB, 2010a:A19).

As with the users, the intended use of the CFfFR is also comprehensive. The intended use of the CFfFR in setting new accounting standards can be summarised as a "meta-accounting standard providing theoretical grounds in order to make newly created accounting standards coherent between one another" (Alexander et al., 2013:9). According to Burlaud and Colasse (2011:28) by using the CFfFR as a "theoretical charter" the IASB "intended to give its standards a quasi-scientific content". The use of the CFfFR as a theoretical charter of a meta-accounting standard⁷⁷ is important when the requirements of a conceptual framework that serves as a theoretical charter or meta-accounting standard, are considered.

The IASB is in agreement with the FASB that the purpose of the CFfFR is to define "the concepts that underlie the preparation and presentation of financial statements" (IASB, 2014a:1). The CFfFR is perceived as a "practical tool that assists the IASB when developing and revising IFRS's" (IASB, 2014a:1). The main purpose of a conceptual framework stated by both the FASB and the IASB is to assist or provide guidance to the standard setting body with the development or revising accounting standards.

The importance of a conceptual framework resides in its role to provide structure to the standard setting process and to provide fundamental concepts and a common set of terms and premises that standards could be based upon (Gore & Zimmerman, 2007). The purpose of a conceptual framework is to ensure that the standards are "consistent with a unified theory of accounting" (Gore & Zimmerman, 2007:30).

4.5 The Objective of a Conceptual Framework in Accounting

Although the objective of the CFfFR is used in this study as the main competency question (section 7.2.1) of the formal domain ontology of the CFfFR, different objective approaches were identified in the literature. The objective of the CFfFR is already included in the title of the CFfFR. It is a conceptual framework for "Financial

⁷⁷ A meta-accounting standard is on a higher level of abstraction than an accounting standard providing broader principles and postulates than what is presented in the accounting standards.

Reporting” (IASB, 2010a). The title commits the CFfFR to deal only with financial information included in financial statements of reporting entities. According to the IASB’s website for the conceptual framework project (IASB, 2014a:1) “the objective of the *Conceptual Framework* project is to improve financial reporting by providing the IASB with a complete and updated set of concepts to use when it develops or revises standards”.

It is important to note that the CFfFR does not intend to be a theoretical base for accounting in general. It also does not propose to be a theoretical base to provide information “for monitoring and rewarding managers’ performance” (Macve, 2010:303). The different objective approaches (section 4.5.1) provide some clarity on the objective adopted in the CFfFR.

4.5.1 Objective Approaches

According Alexander et al. (2013:14) the objectives of conceptual frameworks can be considered from “the classical approach, the decision-usefulness approach and the information economics based approach.”

a) *The information economics based approach*

Under the information economics based approach a conceptual framework “is supposed to enable accounting information to be competitive” (Alexander et al., 2013:15) and is viewed as a commodity like any other in the economy.

b) *The classical approach*

The objectives of the classical approach are the description of existing practice, prescription of future practice and the definition of terms (Alexander et al., 2013). The description of existing practice relates to the inductive research approach to construct a theory of accounting and the prescription of future practice approach relates to the deductive research approach to construct a theory of accounting (Riahi-Belkaoui, 2004).

The joint conceptual framework between the FASB and IASB follows a combination of the classical and decision-usefulness approaches. The classical approach is followed by considering inputs from the accounting community regarding existing practices during the process of setting or revising the conceptual framework for incorporation in the final document (Figure 4.5). The conceptual framework team members (IASB staff) conduct research on proposals received in comment letters by the accounting community and formulate recommendations to the board for consideration. The implication of the process is that the final document based on the existing practices (inductive approach) and research will provide definitions and guidance for future practice (deductive approach).

Although Alexander et al. (2013) state that the description of existing practice and the prescription of future practice cannot not be served together, both practices were used during the historical evolutionary development process of the current conceptual frameworks. Taking the documents and authors that had an influence on

the historical development of the CFfFR into consideration, the result is a hybrid (Riahi-Belkaoui, 2004) between the deductive and inductive approaches to build the CFfFR.

The current process of revising the CFfFR allows a hybrid approach (deductive and inductive) during the different Phases of compiling the document resulting in a compromise between the two approaches (Figure 4.5).⁷⁸

c) *The decision-usefulness approach*

The decision-usefulness approach is evident from the CFfFR when it states that “the objective of general purpose reporting is to provide financial information about the reporting entity that is useful to existing and potential investors, lenders and other creditors” (IASB, 2010a:OB2). The criteria to be used when deciding when information is useful for users are the qualitative characteristics provided in Chapter 3 of the CFfFR (IASB, 2010a).⁷⁹ According to Mumford (1993:27), Stamp advocated that “it was necessary to establish a single, dominant theoretical paradigm to use in setting standards”. Based on the objective of the joint conceptual framework (IASB, 2010a), it can be concluded that decision-usefulness has been established as the dominant, theoretical paradigm in setting accounting standards by both the FASB and the IASB (Whittington, 2008a). Lee (2015) discusses decision-usefulness as basis for financial reporting and the dominance of research on decision-usefulness from a capital market perspective.⁸⁰

In section 4.6, the requirements for a theoretical and technical sound conceptual framework to comply with the needs and purpose, definition, and objective and theory of a conceptual framework for financial accounting reporting stated above, is provided.

⁷⁸ The FASAC (2004) also expressed preference for a hybrid approach to revisit their conceptual framework.

⁷⁹ See Mumford (1993:20–26) for a discussion on qualitative criteria as a basis to determine decision-usefulness of financial information.

⁸⁰ This study is not concerned with the benefits or limitations of the decision-useful objective of the CFfFR. For the purpose of this study, it is sufficient to indicate that decision-usefulness is established as the dominant theoretical paradigm for financial reporting.

PART B: DATA COLLECTED - ABSTRACTION OF REQUIREMENTS AND DEFINITION

In order to understand the characteristics and requirements of a Global CFfFR the system is illustrated in Figure 4.6, starting with the economic and other activities (instances) and ending in the financial report. Within a reporting entity there are numerous activities (*all activities*) of which not all are reported in a financial report. Some of these activities are selected to be reported (indicated as *reportable activities*). The selection process are determined by asking the questions *what* should be reported, *when* should it be reported and *how* should it be reported? The manner in which the selections are made are decided on by applying *financial accounting standards* on the economic activities. In Figure 4.6, IAS 16 and IAS 2 are used as examples to indicate how economic activities are selected by way of financial accounting standards. The fundamental principles regarding the WHAT, WHEN and HOW questions guide financial accounting standards are contained in the Conceptual Framework for Financial Reporting (CFfFR).

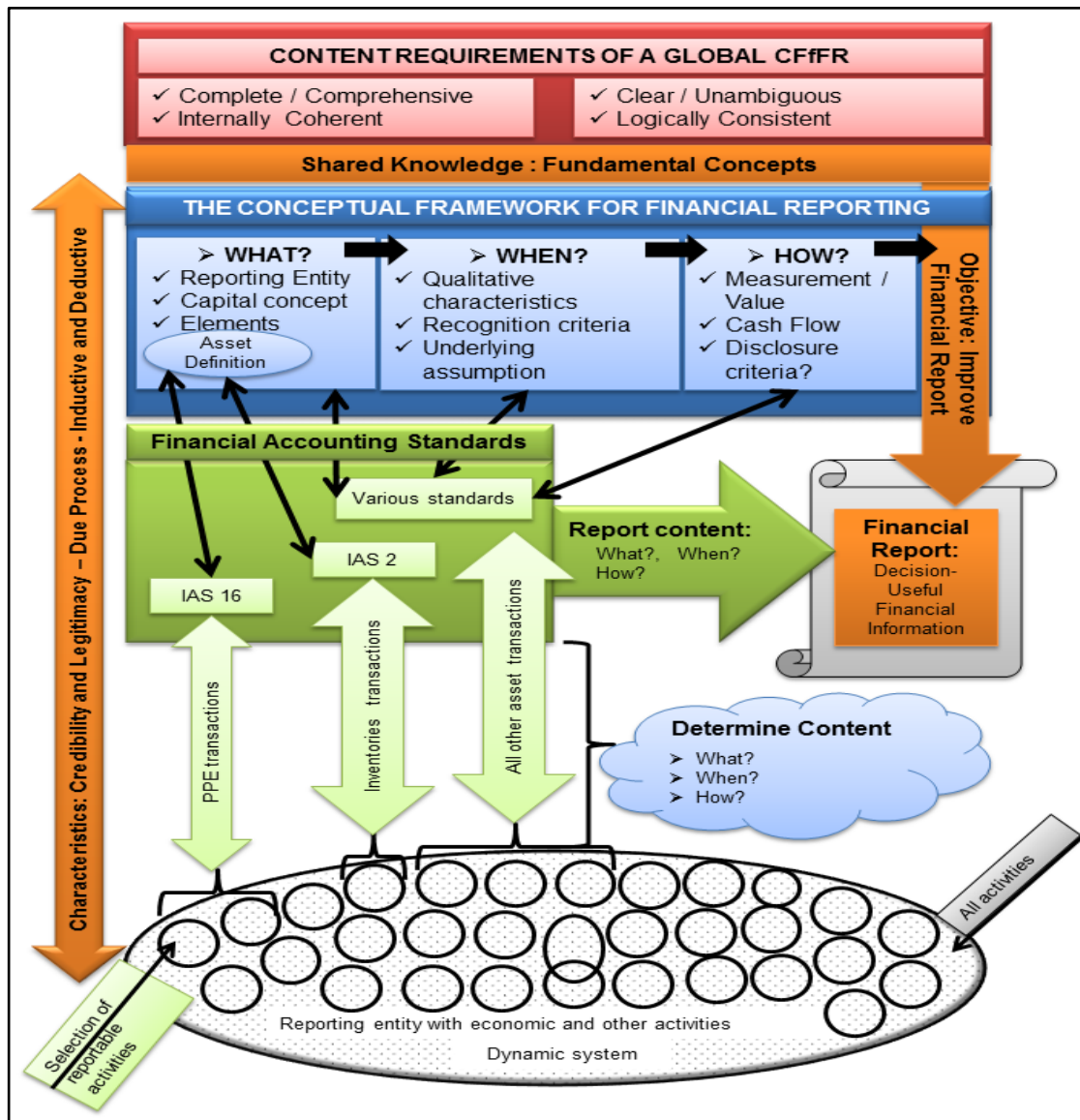


Figure 4.6: Requirements of a conceptual framework

4.6 Characteristics and Requirements of a Global CFfFR

The requirements and characteristics of a global CFfFR are derived from the discussions on the needs (section 4.3.), purposes (section 4.4) and the objective (section 4.5).

The requirements and characteristics can broadly be categorised into two categories. The first category comprises of requirements related to the characteristics and perceptions regarding the standard setting bodies, its processes and the products. The second category comprises of requirements related to the content of the CFfFR document. The two categories are related in that perceptions regarding the one category influence perceptions regarding the other category. Due to the mutual influence of the two categories on each other, an improvement related to the requirements in Category 2 may also cause an improvement in perceptions regarding Category 1. Although the requirements are divided in two categories, some of the requirements in Category 2 flow from the requirements listed under Category 1. This study is focused on testing and evaluating requirements identified under Category 2. The requirements of a CFfFR are illustrated in Figure 4.6.

4.6.1 Category 1: Characteristics and Perceptions

a) *Credibility and Legitimacy*

The purpose and need of the conceptual framework is to provide credibility and legitimacy to standard setters (Alexander et al., 2013; Hines, 1989). The functional and technical reasons for a conceptual framework provide the perception of credibility. Legitimacy is founded on procedural and substantial legitimacies (Burlaud & Colasse, 2011).

The IASB mainly obtains procedural legitimacy through its due process, representation on the board and technical staff. The IASB's due process is representative, inclusive and uses a hybrid method of developing and revising accounting standards and the CFfFR (Figure 4.5). The hybrid method of building a conceptual framework (inductive and deductive) (FASAC, 2004; Riahi-Belkaoui, 2004) (Figure 4.6) includes both experience from practice and research from experts in the field and contributes to the substantial legitimacy of the IASB. The research component demonstrates that the IASB develops and revises accounting standards and the conceptual framework in a fair, logical and professional manner (Alexander et al., 2013; Peasnell, 1982). During revision of the CFfFR the foundations of the fundamental concepts are re-examined using new knowledge and evidence (Chambers, 1996; IASB, 2013a).

b) *CFfFR as a body of shared knowledge*

According to the information demand, a conceptual framework serves as a body of shared knowledge (Watts & Zimmerman, 1979) and as basis for agreed upon knowledge at a specific time (Moonitz, 1963; Whittington, 2008b). When the CFfFR is used to serve as basis for further research and training it adheres to the pedagogic demand (Watts & Zimmerman, 1979). The CFfFR represents, in a condensed form, a

culmination of shared knowledge regarding financial reporting at a specific time in history (Figure 4.6). The body of shared knowledge as characteristic of the CFfFR provides the vocabulary for the CFfFR ontology motivates and justifies the use of the CFfFR as a basis for the CFfFR ontology.

c) Objective of the CFfFR: Improve the Financial Report

The objective of the CFfFR “is to improve financial reporting by providing the IASB with a complete and updated set of concepts to use when it develops or revises standards” (IASB, 2014a:1). The set of fundamental concepts provide guidance to select and disclose transactions and other events and conditions (economic activities) about a reporting entity that is useful to users of financial reports in making investment and other decisions (FASB, 2010a; Whittington, 2008a). The objective of the CFfFR as stated above requires that the CFfFR should provide the fundamental concepts on an abstract level to ensure that decision-useful information is provided to the users of financial reports (Figure 4.6). As it is required that the CFfFR should provide fundamental concepts regarding financial reporting, it justifies the use of the CFfFR as basis for the ontology developed in this study.

d) Agreed paradigm: Decision-useful Financial Information

The objective of the CFfFR is in accordance with decision-usefulness (Figure 4.6) as the dominant and established theoretical paradigm in setting accounting standards (FASB, 2010a; IASB, 2010a). The CFfFR serves as a meta-accounting standard to provide guidance to board members of standard setting bodies (Alexander et al., 2013; Whittington, 2008a). Decision-usefulness as the dominant and established theoretical paradigm in standard setting was determined to be the main competency question and objective of the CFfFR ontology (section 7.2.1, Figure 4.6).

4.6.2 Category 2: Content Requirements of a Global CFfFR

Figure 4.6 provides an illustration on how the characteristics and requirements for a Global CFfFR functions within the financial reporting domain to ensure that the objective of providing decision-useful financial information to the users of financial reports are achieved. The content of financial reports are determined by asking *what* economic activities should be reported, *when* should the activities be reported and *how* these activities should be reported? The CFfFR should contain the fundamental concepts regarding the *what*, *when* and *how* of economic activities. In order for the CFfFR to be globally acceptable the *what*, *when* and *how* content should be **complete and comprehensive, internally coherent, clear and unambiguous** (without unintended meanings), and **logically consistent**.

a) Content Requirements of a global CFfFR: Structure of the CFfFR: What?, When?, and How?

Figure 4.6 demonstrates how the CFfFR contributes towards decision-usefulness as the objective of financial reporting, thus enhancing the requirements of a global CFfFR. The current content of the CFfFR is organised according to a decision matrix based on three basic questions (Deegan, 2014). The three questions are based on

the FASB conceptual framework, Statement of Financial Accounting Concepts No. 8.⁸¹ According to the FASB (2010a:iv) the concepts forming the basis for the development of financial accounting and reporting guidance are the fundamental “concepts that guide the selection of transactions and other events and conditions to be accounted for; their recognition and measurement; and the means of summarising and communicating them to interested parties”.

The three questions of the decision matrix are what, when and how:

1. **What?** – The fundamental “concepts that guide the selection of transactions and other events and conditions to be accounted for”. The first question is what transactions and other events and conditions (economic activities) should be selected to be reported? To be able to select the economic activities the reporting entity should firstly be identified. The concept of capital and capital maintenance should be adopted by the reporting entity. The elements of the financial statements should be defined. The definitions should be at such a level of abstraction that it can function inductively and deductively regarding all economic activities. It should be able to test all economic activities against a definition and the definitions should provide enough guidance to set standards that cover all economic activities.
2. **When?** – “Their recognition and measurement”. The second question is when should the economic activities be reported? The second question is answered by ensuring that the reporting entity adheres to the underlying assumption of going concern. Once the economic activities have been identified by answering the “what” question, the selected transactions should adhere to the qualitative characteristics of useful financial information and the recognition criteria. The economic activities to be reported are identified by answering the when question.
3. **How?** – “The means of summarizing and communicating them to interested parties.” The third question is how should the economic activities be reported to be useful to the identified users of the financial statements? Guidance regarding measurement and valuation of the economic activities should be provided. Criteria regarding the disclosure of the economic activities should guide the information to be reported. The last fundamental concept to be reported is the cash flow effect of the economic activities.

The schematic presentation uses the asset element to illustrate the process of abstraction according to the hybrid methodology of research, from the economic activities in the reporting entity to the definition of asset in the CFfFR. The importance of the CFfFR to comply with the requirements is that it should comply with the requirements in order to fulfil the needs and purpose, objective and be true to the definition of a global CFfFR.

⁸¹ As the CFfFR is structurally based on the Statement of Financial Accounting Concepts by the FASB, the same structure applies to the CFfFR.

b) Content Requirements of a global CFfFR: Complete and Comprehensive

A global CFfFR should be *complete* to cover all possible economic activities to be reported (Clark, 2008; Whittington, 2008a). If it is accepted that the CFfFR should provide the fundamental concepts of the shared knowledge regarding decision-useful information, then the content of a global CFfFR should cover all possible economic activities in the fundamental concepts. The notion of completeness is confirmed in Chapter 5 where the role of the CFfFR is determined to be that of a meta-metamodel within the financial reporting domain (Figure 5.12). Completeness is described as “the economic phenomena that are relevant to investors, creditors, and other users making investment, credit and similar decisions” (FASAC, 2004:8). Completeness is directly related to the objective of the CFfFR as the information that is useful to the primary users of the CFfFR (Whittington, 2008a).

The level of abstraction in the CFfFR should be sufficient to provide a *comprehensive summary of the fundamental concepts* from which other concepts can be derived. The fundamental concepts should be able to serve as a basis to draft and revise principle-based accounting standards (FASAC, 2004; IASB, 2010a). The importance of comprehensiveness for the purpose of abstraction is emphasised by the *conform_to* relationship between models in Chapter 5 (Figure 5.12).

c) Content Requirements of a global CFfFR: Internally Coherent

A global CFfFR should be *internally coherent* to provide consistent guidance to standard setters (Clark, 2008; Whittington, 2008a). The function of the CFfFR to provide guidance to standard setters emphasises the requirement of coherence. Clark (2008) emphasises the importance of coherence and that inconsistencies exist in the FASB and IASB conceptual frameworks. Clark (2008:60) states that “if an accounting framework is to set out the concepts and principles that underlie the preparation and presentation of financial statements designed to meet the needs of the user of those statements, the concepts and principles contained within it need to be sound, comprehensive and internally coherent. When they decided to revise the FASB’s framework, the SEC staff stated that in order to set principles-based standards, each standard should be “drafted in accordance with the objectives set by an overarching, coherent conceptual framework meant to unify the accounting system as a whole” (FASAC, 2004:7). The two requirements by the SEC staff are completeness (overarching and accounting system as a whole) and internal coherency.

d) Content Requirements of a global CFfFR: Clear and Unambiguous

The fundamental concepts in a global CFfFR should be *formulated clearly and unambiguously* with no unintended meanings to provide guidance in the selection between alternative interpretations of financial standards and to eliminate conflicting interpretations of the fundamental concepts (FASAC, 2004; FASB, 2010a). This requirement is rooted in the teleological principle fundamental to the Roman law system (section 4.3.4) (Alexander et al., 2013). According to the teleological principle, the CFfFR is the basis to interpret IFRS’s when there are ambiguities in the IFRS’s

and provides a theoretical framework to distinguish between different accounting practices and interpretations (DePree, 1989). The CFfFR serves as a frame of reference to narrow down areas of differences and eliminate indeterminacies, divergences and inconsistencies in accounting standards (Chambers, 1963). In order for a global CFfFR to fulfil this role, the content of the global CFfFR should be formulated clearly and unambiguously to eliminate misunderstandings and divergent interpretations.

e) **Content Requirements of a global CFfFR: Logically Consistent**

A global CFfFR should be *logically consistent* to achieve scientific credibility in the accounting community. The importance of consistency of accounting standards is emphasised by Wüstemann and Wüstemann (2010) and Clark (2008). According to Pike and Chui (2012:78) the FASB noted that “certain aspects of the conceptual framework are incomplete, internally inconsistent, and ambiguous”. This means that the FASB requires a conceptual framework that is complete, internally consistent and unambiguous. The FASAC (2004) stated that a common framework between the FASB and the IASB should be internally consistent and complete in order to help the board to issue principles-based standards. As the IASB and the FASB jointly decided to initially revise their respective conceptual frameworks, it can be assumed that the IASB also values the requirements of completeness, logical consistency and unambiguity of the CFfFR.

4.7 A Proposed Definition for a Global CFfFR

The requirements for a global CFfFR identified in section 4.6 was used as a guide in the proposed definition for a Global CFfFR. Based on the joint conceptual framework project between the IASB and the FASB, the FASB’s Statement of Financial Accounting Concepts No. 8 (FASB, 2010a) is used as source to obtain a definition for a conceptual framework from both the FASB and the IASB.⁸²

Although the FASB does not explicitly specify a definition, the following serves as a working definition for a conceptual framework: “The Conceptual Framework is a coherent system of interrelated objectives and fundamental concepts that prescribes the nature, function, and limits of financial accounting and reporting” (FASB, 2010a:iv). The wording of the definition by the FASB (2010a) was mainly copied from the FASB’s discussion memorandum on the conceptual framework where it was stated that a conceptual framework is a constitution, a coherent system of interrelated objectives and fundamentals. A conceptual framework with these characteristics can lead to consistent standards that prescribes the nature, function, and limits of financial accounting and financial statements (FASB, 2010b).

⁸² As this study is concerned with the Conceptual Framework published by the IASB (2010a), the IASB’s definition of a conceptual framework would be the logical starting point. However, the IASB’s web page does not provide a definition of a conceptual framework and neither does it provide a definition of a conceptual framework in the CFfFR (IASB, 2010a).

The most important difference between the two definitions of a conceptual framework provided by the FASB is the omission of “constitution” in the 2010a definition. The omission is an indication that the FASB moved away from the idea that the conceptual framework serves as a constitution. A conceptual framework is viewed by some scholars as a constitution to guide standard setters with setting accounting standards (DePree, 1989; Gore & Zimmerman, 2007). Chambers (1996:119) also mentions that the conceptual framework in accounting is “a constitution prescribing the nature of accounting and its products”. The function of a constitution is that it serves as the highest law, that all other laws are subordinate to the constitution and that they should be in agreement with the constitution (Chambers, 1996).

If the CFfFR is defined as a constitution, the implication is that all accounting standards are subordinate to the CFfFR and that accounting standards may not deviate from the principles provided in the CFfFR. The IASB (2010a:A25) however, states that “this *Conceptual Framework* is not an IFRS and hence does not define standards for any particular measurement or disclosure issue. Nothing in this *Conceptual Framework* overrides any specific IFRS”. It is evident from this statement that the CFfFR of the IASB cannot function as a constitution for IFRS’s. This is consistent with the omission of the word “constitution” in the FASB 2010a joint conceptual framework. The FASB (2010a:v) declares that “Concepts Statements are not part of the *FASB Accounting Standards Codification*” and “that in certain respects current generally accepted accounting principles may be inconsistent with those that may derive from the objectives and fundamental concepts set forth in Concepts Statements”. The FASB conceptual framework cannot be a constitution for U.S. GAAP. It is concluded that, based on the functioning of the FASB and IASB conceptual frameworks, the FASB and the IASB do not want their conceptual frameworks to function as a constitution. Although the IASB does not intend the CFfFR to function as a constitution, the role of the CFfFR as a meta-metamodel is argued in Chapters 5 and 6.

The two other changes are the addition of “concepts” and the omission of “can lead to consistent standards” in the CFfFR. The addition of “concepts” emphasises that the conceptual framework is dealing with basic and fundamental concepts providing an indication of a level of abstraction. The notion of abstraction plays an important role in establishing the role of the CFfFR as a meta-metamodel in Chapters 5 and 6.

“Can lead to consistent standards” is replaced with “and that is expected to lead to consistent guidance” providing the benefit of the conceptual framework to the standard setting bodies by providing guidance. The benefit is focused on guidance to the board in the CFfFR and does not claim that it could lead to consistent standards as in the 1976 document. The expectation of the benefit regarding the accounting standards is lowered in the CFfFR. Some other characteristics and requirements of a conceptual framework for accounting are explored in other accounting literature.

Chambers (1996:124) agrees with Vatter (1947:1) that every science needs some conceptual structure i.e. “a pattern of ideas brought together to form a consistent whole or a frame of reference to which is related the operational output of that field”. A conceptual structure implies a certain degree of abstraction from the reality.

Chambers (1996) borrowed from the natural sciences to define a conceptual framework with reference to Bohr (1961:67) who defines a conceptual framework as “the unambiguous logical representation of the relationships between experiences”. Chambers (1996:124) defines a conceptual framework as “a body of propositions describing ‘concepts’, ideas entertained about matters open to observation or experience, and supposed or confirmed relationships between those matters.”

The requirements for a conceptual framework derived from the definitions and other literature explored above are that a conceptual framework should be:

- a coherent and consistent representation (Chambers, 1996; Whittington, 2008a) of
- fundamental concepts (FASB, 2010a) and
- the relationships between the concepts (Chambers, 1996)
- prescribing the nature, function, and limits of financial reporting (FASB, 2010a)
- in an unambiguous logical manner (Bohr, 1961).

Based on the needs and purpose of a conceptual framework for accounting, the definitions obtained from literature and the working definition provided by the FASB, the following is proposed as a possible definition for a conceptual framework that complies with the needs and purpose of the CFfFR.

A conceptual framework for financial reporting is an internally coherent and logically consistent representation of fundamental concepts that unambiguously prescribes the nature, function and limits of financial reporting.

4.8 Evaluation of the CFfFR Against the Requirements of a Global CFfFR

The requirements for a global CFfFR represent the construct artefact as output of the Development Step of DSR Cycle 1. The requirements as construct artefact functions as the first evaluation step in the FEDS Human Risk & Effectiveness verification strategy. By testing the CFfFR against the requirements and definition of a Global CFfFR it was determined if the artefact could serve as discussion vocabulary to contribute towards improving the CFfFR. Figure 4.7 provides a graphic illustration of the function of the requirements and definitions in the FEDS verification strategy.

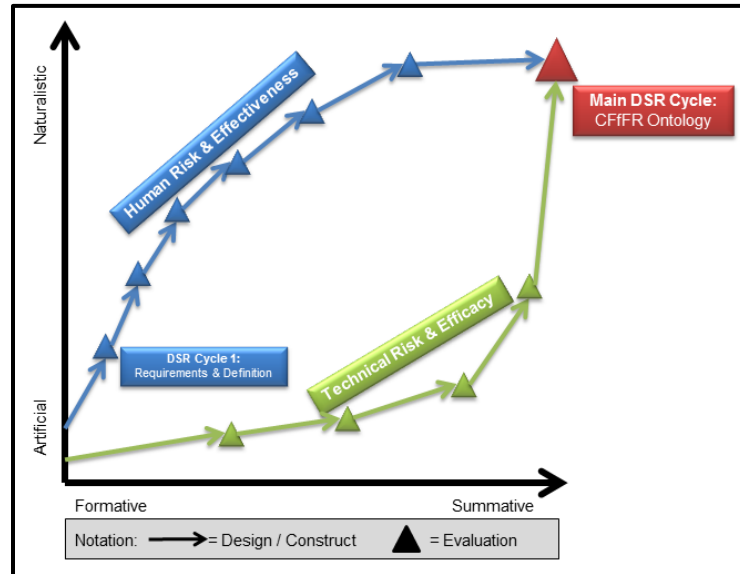


Figure 4.7: FEDS Strategy - DSR Cycle 1

One objective of this study is to determine if and how the CFfFR complies with the requirements as indicated in section 4.6. Section 4.8 is the Evaluation Step of DSR Cycle 1 (Figure 4.2). In this study, the position is taken that the CFfFR does not comply with the requirements and definitions of a global CFfFR as determined in sections 4.6 and 4.7. Section 4.8 provides an overview of how the CFfFR aligns with the requirements identified.

4.8.1 Complete and Comprehensive

The CFfFR is not complete as the chapters regarding the reporting entity is still outstanding (IASB, 2010a) and provides little guidance on measurement, presentation, and disclosure criteria (IASB, 2013a).

According to the IASB the CFfFR is outdated and should be updated to reflect the current thinking of the IASB (IASB, 2013a). The IASB (2013a:5) acknowledges that “guidance in some areas” of the CFfFR is unclear and that the “existing definitions of assets and liabilities could be improved”.

4.8.2 Internally Coherent

The FASAC (2004:6)⁸³ acknowledged that “certain aspects of the framework are inconsistent with others, and those inconsistencies need to be eliminated”. The framework was also not complete and was “becoming less helpful in providing guidance to the board for making standard-setting decisions”. The coherence of the CFfFR are tested and reported on during the building of the formal domain ontology of the CFfFR.

⁸³ As the IASB and the FASB initially jointly decided to update their respective conceptual frameworks and the CFfFR is based on the FASB conceptual framework it is assumed that both the FASB and IASB accept that there are inconsistencies in their respective conceptual frameworks.

Neither the IASB's CFfFR nor the FASB's existing framework meet these criteria. Hoffmann and Detzen (2013) and Storey and Storey (1998) confirms Clark's statement that the IASB's and the FASB's frameworks are not internally coherent. The result of the frameworks not being coherent is that some standards are inconsistent with the guidelines offered by the framework (Booth, 2003; Nobes, 2005).

4.8.3 Clear and Unambiguous Formulation

As one of the requirements of a formal domain ontology is that the meaning should be clear and exact. At this stage of the study it expected that there could be unintended meanings (ambiguities) in the CFfFR. During the building process of the formal domain ontology (DSR Cycle 4) the CFfFR was tested for unintended meanings. The results indicating unintended meanings in the CFfFR are documented in Chapter 7.

4.8.4 Logically Consistent

Although it is evident from the IASB, the FASB and other authors that the frameworks are not internally coherent, it could not be confirmed from the literature if the frameworks are logically consistent. The reason might be that it is not easy to test for or prove logical consistency. Logic is a highly specified field in philosophy and mathematics that is not accessible to the average accountant and user of the CFfFR.

One of the advantages of using ontology technologies to build a formal domain ontology is that logical consistency can be tested. Reasoners are used to test the logical consistency of concepts and relationships.

Once the requirements and definition for a global CFfFR was identified and it was indicated that the CFfFR does not comply with these requirements, it is suggested that the role of global CFfFR is determined. The identification of the role of the CFfFR within the financial reporting domain is a refinement of the requirements and contributes to determine the applicability of formal domain ontologies on the CFfFR.

4.9 Conclusion

During the literature review in Chapter 2 the overall awareness of a global CFfFR was identified. It was then *suggested* that the main research question may be answered by developing a method to build a CFfFR that adheres to the requirements of a global CFfFR. The outcome of the overall tentative design of the Suggestion Step was to develop a formal domain ontology of the CFfFR. In order to answer the main research question, three sub-research questions were formulated. The three sub-research questions were answered during the four sub-DSR Cycles.

The first cycle of the DSR strategy was to identify the requirements that a globally acceptable CFfFR should adhere to. During DSR Cycle 1, a systematic review was performed to partially answer the first sub-research question. In section 4.6, the Evaluation Step of DSR Cycle 1, it was established that the CFfFR does not comply with the requirements of a globally acceptable CFfFR.

In order to determine the importance and status of the CFfFR it was suggested at the end of DSR Cycle 1 that the role of a global CFfFR within financial reporting should be determined. This led to the awareness to be determined in DSR Cycle 2 and the suggestion was to determine the role of a global CFfFR from a model perspective. With the execution of the Development Step of DSR Cycle 2 the first sub-research question was answered.

CHAPTER 5

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5 THE ROLE OF A GLOBAL CFfFR AS A MODEL

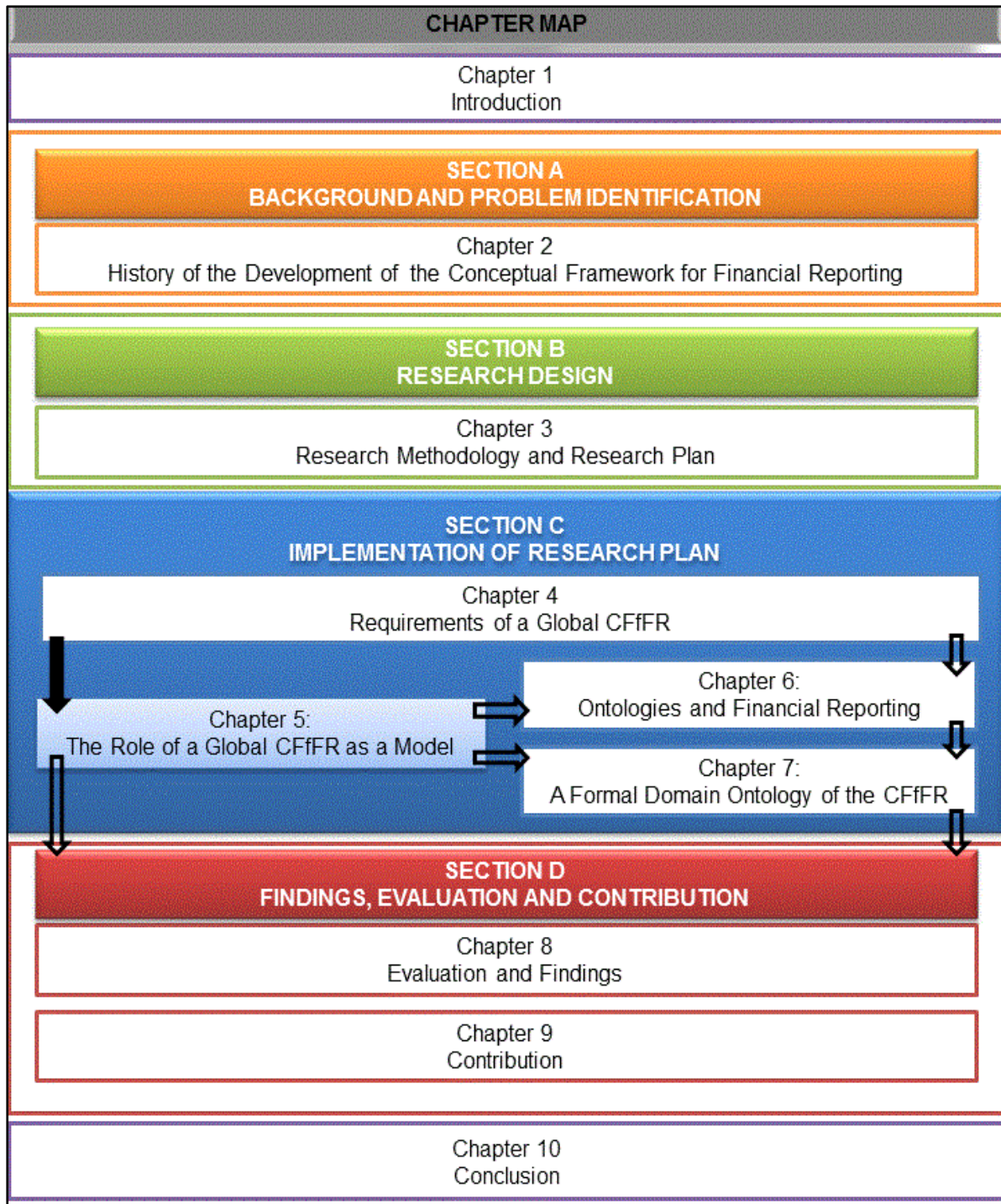


Figure 5.1: Chapter map - Chapter 5

5.1 Introduction



Figure 5.2: DSR Cycle 2

Chapter 5 is an interdisciplinary study adding to accounting some theoretical background regarding the value and use of models from philosophy of science and computing.⁸⁴ The role of a global CFfFR from a model perspective was determined from a philosophy of science and computing perspective. In Chapter 4 the first sub-research question (what is the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?) was partially answered. An overview of the structure of Chapter 5 is provided in Figure 5.3.

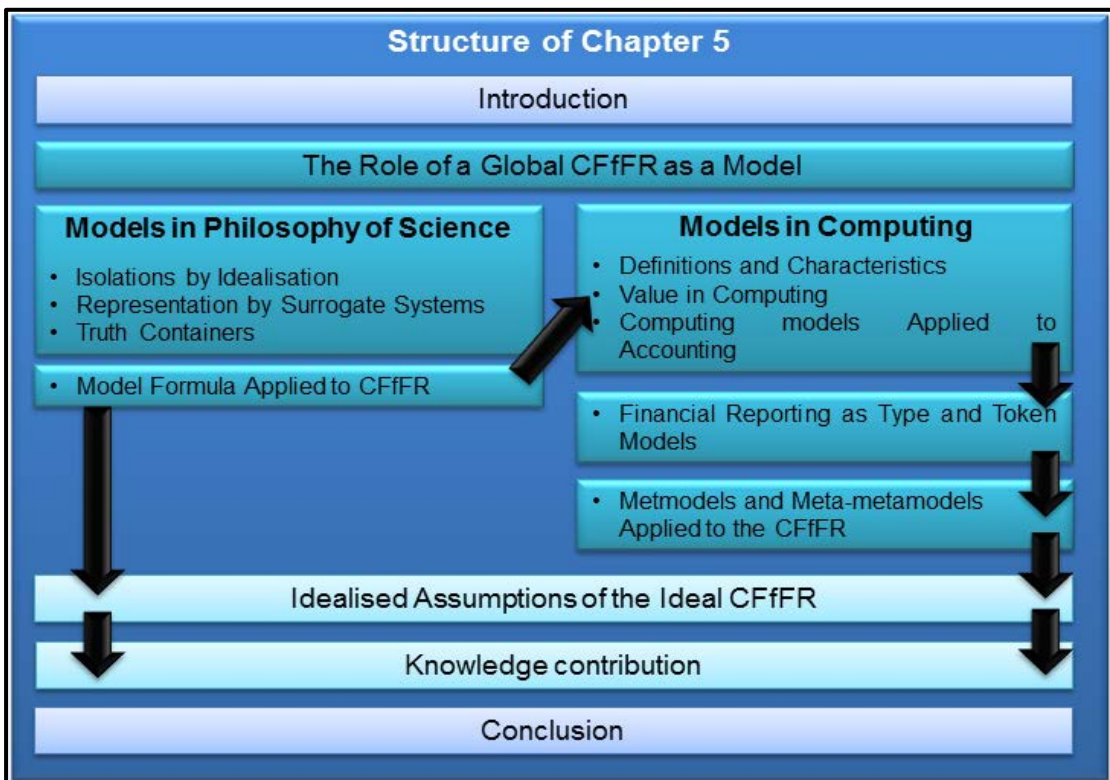


Figure 5.3: Structure of Chapter 5

According to the DSR strategy (Figure 3.3 and Figure 5.2), the evaluation of the requirements for a global CFfFR resulted in the awareness that the role of a global

⁸⁴ Computing is used to refer to both Computer Sciences and Information Systems.

CFfFR within financial reporting should be investigated in order to determine the value of a global CFfFR in the financial reporting domain. Based on the Awareness Step it was *suggested* in Chapter 5 that the role of the CFfFR should be investigated from a model perspective. The Suggestion Step entailed the investigation of the functioning and role of models within other disciplines (i.e. philosophy of science and computing) as no evidence could be obtained to explain the role of the CFfFR as a model within financial reporting.

The investigation of the role of models from philosophy of science and computing provides the theoretical motivation required by the second sub-research question (how can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?).

The suggestion to develop the role of the CFfFR within financial reporting from a modeling perspective was taken from a publication by Ryan et al. (2002). According to Ryan et al. (2002) the dominant methodology of research in the financial disciplines (in 2002) was based upon models rather than theories. "It appears that the notion of the 'model' as an abstraction of reality is a more meaningful concept for practicing researchers to handle than the notion of theory" (Ryan et al., 2002:28).

An interdisciplinary study was used as research technique to determine the role of the CFfFR and was adopted during the Development Step of DSR Cycle 2. The interdisciplinary research involved the following steps:

1. Identify the knowledge need in the primary discipline.
2. Identify the potential secondary discipline(s) that could contribute to provide and answer to the knowledge need in the primary discipline.
3. Identify complementary knowledge between the different disciplines.
4. Apply the complementary knowledge obtained from the secondary discipline(s) to the knowledge need identified in the primary discipline.
5. Report on the findings and contribution of knowledge in the primary discipline.

Step 1 of the interdisciplinary study forms part of the Suggestion Step of DSR Cycle 2. In Step 2, the theory and functioning of models philosophy of science and computing were identified as the possible secondary disciplines that could contribute knowledge towards the primary discipline. During Step 3, it was identified that models are used as representational tools (Grüne-Yanoff & Mäki, 2014). In this study, during Step 4 and Step 5, techniques are adopted from philosophy of science and computing to assist in determining the role and function of the CFfFR as a model within the financial reporting domain.

During the Development Step of DSR Cycle 2 (sections 5.2, 5.3 and 5.4), the use and value of models as truth containers as described by Mäki (2009) are applied to the CFfFR to refine the role and requirements of the CFfFR (section 5.2) as described in Chapter 4. The first output from the Development Step is a construct artefact. The idea of an ideal CFfFR (sections 5.2.3 and 5.2.4) as construct artefact provides the vocabulary and conceptualisation regarding the role of the CFfFR ontology bearing truth regarding the CFfFR.

The use of models in computing is described in section 5.3 and provides the second output, a model artefact, of the Development Step of DSR Cycle 2. The use of models in computing was applied to the financial reporting domain in section 5.3.4. In section 5.3.5, the role of the CFfFR as a meta-metamodel within financial reporting is described.

Based on the discussion in sections 5.2 and 5.3, the third artefact of DSR Cycle 2 (a construct artefact), the idealised assumptions regarding an ideal truth bearing CFfFR model were developed to determine the ideal role of the CFfFR (section 5.4). Chapters 2 and 4 were revisited in the light of the adoption of the ideal truth-bearing model of Mäki (2011) and, based on the work done in Chapters 2 and 4, additional idealised assumptions were identified and formulated and reported on in section 5.4. The three artefacts developed during DSR Cycle 2 provided the knowledge to move to DSR Cycle 3 and determine the applicability of ontology (from philosophy) and ontology technologies (from computing) are applicable to the ideal and global CFfFR.

The three artefacts developed during DSR Cycle 2 answers SRQ 1 and SRQ 2 (Table 3.6). These three artefacts, the idea of an ideal CFfFR, the role of a global CFfFR as a meta-metamodel and the ideal assumptions are evaluation Points 2, 3 and 4 on the Human Risk & Effectiveness evaluation strategy (Figure 5.13).

5.2 Models in Philosophy of Science

The value and use of models are not foreign to accounting research. Mathematical models are highly valued in financial accounting research (Watts, 1982). Mathematical models form part of quantitative studies. In section 5.2, the value of models as truth bearers is explored from a more philosophical perspective applied in a qualitative study. The value of models from a philosophy of science perspective is that models can be true and that they function as truth bearers of target systems (Mäki, 2008; Mäki, 2009; Mäki, 2011). According to Mäki (2009:37) “models function as epistemic devices in that the modeller examines the properties and behaviour of a model as a surrogate system in order to learn about the target system”.

In order to follow the explanation of the different qualities of a model, the following formulation of a model is provided and depicted in Figure 5.4 (Mäki, 2009:32):

- “Agent *A*
- uses object *M* (a model) as
- a representative of some target system *R*
- for Purpose *P*,
- addressing *Audience E*,
- prompting genuine issues of resemblance to arise,
- and applies *Commentary C* to identify and align these components”
- all happening within the boundaries of *Context X*.
- The model can be *Described (D)* in various ways: verbal, mathematical, diagrammatic, pictorial etc.

Mäki provided the unpublished schematic representation in Figure 5.4 of his model formulation during a visit to the University of Pretoria in 2014⁸⁵:

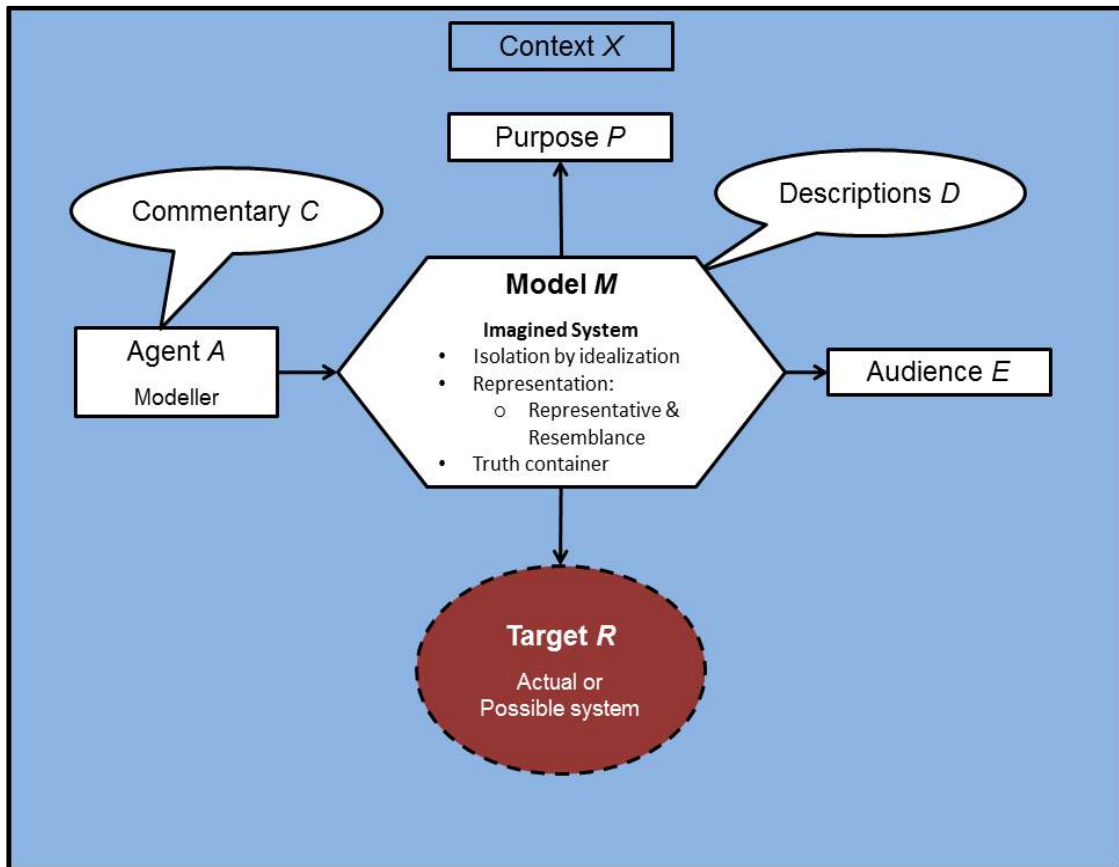


Figure 5.4: Model formulation (Mäki, 2011)

Mäki (2009; 2011) proposes a three act technique in order for models to be truth bearers namely, (a) models as isolations by idealisation (section 5.2.1), (b) models as representations by surrogate systems (section 5.2.2), and (c) models as truth containers (section 5.2.3).

Figure 4.6 is an example of a pictorial model isolating and representing the characteristics and content requirements of a global CFfFR. In terms of Mäki (2009; 2011) the model can be explained as follows:

- “Agent *A* is the researcher of this study.
- Object *M* (Figure 4.6) is the graphic illustration as an imagined system isolating and representing the role of the characteristics and requirements of a global CFfFR. within the financial reporting domain.
- The target system *R* is the role and requirements of the CFfFR within the financial reporting domain.

⁸⁵ The context *X* and description *D* were provided by Mäki during a lecture at the University of Pretoria in 2014.

- The Purpose P of object M is to isolate and represent on an abstract and conceptual level the characteristics and content requirements of a global CFfFR.
- The primary audience E is the readers of this document.
- The model prompts the issues of resemblance of the role of the CFfFR within the financial reporting domain.
- The discussion in Chapter 4 serves as the Commentary C to identify and align these components.
- This discussion is firstly happening within Context X , the boundaries financial reporting as utilised in this thesis.
- The model is Described (D) as a pictorial model (Figure 4.6) of an abstract concept – the characteristics and content requirements of the CFfFR within the financial reporting domain.

5.2.1 Models as Isolations by Idealisation

The first act technique of a model as isolation by idealisation is to imagine, isolate and assume the ideal situation regarding the chosen semantic domain under investigation. A very complex system or certain aspects of a complex system are controlled by isolating some important fact, dependency relation, causal factor or mechanism of the system under investigation (Mäki, 2009). Isolation is achieved by making idealised assumptions regarding strategic aspects (Mäki, 2011). These assumptions “are purposeful falsehoods that are strategically mobilized and manipulated” (Mäki, 2011:51).

The modeller isolates what is to be investigated by assuming that “certain potentially efficacious factors are absent, constant, or in normal or otherwise suitable states” (Mäki, 2009:30). Isolation simplifies a complex system (target) in order to investigate certain aspects of the target. The model is then an imagined system. “In building a model one imagines a surrogate world, which involves an active process of constructions whereby isolations are accomplished” (Mäki, 2009:32).

In this study, the surrogate world is a formal domain ontology of the CFfFR. The purpose of the formal domain ontology is to serve as a model to investigate certain aspects of the CFfFR. The formal ontology model is based on idealised, false assumptions in order to isolate the aspects investigated.

The requirements and definition developed in Chapter 4 are based on the systematic review of what are perceived, prescribed and argued to be the requirements of the CFfFR by academics, practitioners and legislators. The results of Chapter 4 are used as basis to formulate some of the idealised assumptions to achieve the drafting of a global CFfFR. Some idealised assumptions provided in section 5.6 are based on the literature review done in Chapter 2 and confirmed by the discussion in Chapter 4. These assumptions are purposeful falsehoods and strategically manipulated to isolate and investigate the role and requirements of a global CFfFR. The requirements isolated are *complete and comprehensive, internally coherent, logically consistent, and clear and unambiguous* (Figure 4.6).

5.2.2 Models as Representations by Surrogate Systems

The second act technique is to outline models as representations by surrogate systems (Mäki, 2011). Mäki (2009) qualifies his account of models as representations by surrogate systems in two ways. Mäki (2009) firstly, distinguishes between *representative* quality aspects and *resemblance* quality aspects of representations, and secondly embeds models in a pragmatic context. Modeling as representation involves a subject, the agent A or modeller, and an object, the Target R , which is modelled (Figure 5.4).

The *representative* quality aspect of representation is the result of a voluntary activity of the agent A . It can be activities such as imagination of the ideal situation and selective choices to isolate the aspect to be investigated. Regarding the *representative* quality aspect of a model, the Model M should firstly represent some target system R and stands as a surrogate for that target. Mäki (2009) explains the epistemic function of models as surrogate in that one acquires information of the Target R without examining R directly, but rather examines M directly. M is examined by an inquiry into its properties and behaviour, acquiring information about R indirectly.

The *representative* quality aspect is applied to the financial reporting domain in two ways. Firstly, the fundamental concepts related to the “what”, “when” and “how” of financial reporting are the Target R of the CFfFR M . Secondly, the CFfFR is the Target R .

The *resemblance* quality aspect of representation involves an involuntary dimension of the Target R . Resemblance is ontologically and pragmatically constrained (Mäki, 2009). “The ontological constraints are due to the objective properties of the target, while the pragmatic constraints derive from the purposes and audiences of modeling” (Mäki, 2009:33). Regarding *resemblance* as the second representation quality aspect of a model, M should resemble or correspond to the Target R . Resemblance is important in order to learn something about R by inquiring M . The resemblance should be in suitable respects and in sufficient degrees (Mäki, 2009). Issues of resemblance should be genuine in two ways: (1) “the model must have a likely capacity to resemble” (Mäki, 2009:33), meaning resemblance must not be utopian or beyond the reach of the modeller, and (2) resemblances must be relevant otherwise resemblances do not count.

Within the context of financial reporting, *resemblance* between the semantic domain of financial reporting and the CFfFR is achieved by the nature and process of drafting the CFfFR. The due process of the IASB (see Figure 4.5) is a mechanism to involve as many representatives of the domain as possible when drafting the CFfFR and financial accounting standards. This process enhances the resemblance quality between the CFfFR as Model M and the semantic domain of financial reporting, Target R .

The representation act technique of models should be viewed within the context of the different aspects forming part of the formulation of a model (Figure 5.4). The

pragmatic *context X* “includes the modeller’s purposes, audiences and commentary” (Mäki, 2009:32). The pragmatic context of this study is to obtain a Ph.D. degree (purpose) by reporting on a research project by way of writing a dissertation (commentary) to be evaluated by supervisors and examiners (audience). The research project is focussed on answering three sub-research questions and a main research question by building a formal domain ontology of the CFfFR.

The *Purpose P* of representation can be either epistemic or non-epistemic. The epistemic purpose can be to answer some limited and explanatory questions or isolating an important mechanism or aspect of Target *R*. The non-epistemic purpose involves the solving of some practical problem or helping in policy-making (Mäki, 2009).

The epistemic purpose of Model *M* in this study is to isolate and test internal coherence, logical consistency, clarity of meaning and the role and definition of the CFfFR. The non-epistemic purpose is to provide a model i.e. a formal domain ontology of the CFfFR, that could provide a model and method that could assist standard setters towards the setting of a global CFfFR.

The *Audience E* of the study is mainly academics with the possibility to reach experts in practice on the CFfFR. From the perspective of the pragmatic context of the study, the audience can be described as the supervisors and examiners of this research project. *Commentary C* is provided by the modeller on modeling results and modeling decisions made during the modeling process. The *Commentary C* includes the method, process and requirements to build a formal domain ontology of the CFfFR as well as the results of the study that are provided as the findings in Chapter 8.

The *Description D* of the formal domain ontology of the CFfFR is in a formal language called Description Logics (DL). The model is also presented in a graphic format, prepared by the software program Protégé. Table 5.1 provides a summary of modeling as representation.

Table 5.1: Modeling as representation

REPRESENTATION QUALITIES	
Representative quality	Resemblance quality
Voluntary action by agent <i>A</i> . <ul style="list-style-type: none"> Imagination of ideal situation Selective choices decided by modeller. 	Involuntary dimension of Target <i>R</i> . <ul style="list-style-type: none"> Real world Target <i>R</i> to “decide” on properties.
Model <i>M</i> stands as surrogate for Target <i>R</i> .	Constraints: <ul style="list-style-type: none"> ontologically – properties of the target; pragmatically – purposes and audiences of modeling.
	Model <i>M</i> must correspond to Target <i>R</i> in suitable respects and in sufficient degrees.
Examine Target <i>R</i> indirectly by examining properties and behaviour of Model <i>M</i> .	Resemblance must be genuine in two ways: <ul style="list-style-type: none"> Model <i>M</i> must have a likely capacity to resemble, resemblances must be relevant.
REPRESENTATION	
<i>Pragmatic context X</i> Modeller’s purpose, audiences and commentary	
<i>Purpose P</i> : Epistemic or non-epistemic	

Epistemic function: <ul style="list-style-type: none"> • Acquires information of Target R without examining Target R directly. • Acquires information of Target R by examining Model M directly. 	Non-epistemic <ul style="list-style-type: none"> • Solving a practical problem. • Helping in policy-making.
<i>Audience E</i> Users of the model.	
<i>Commentary C</i> <ul style="list-style-type: none"> • Modeling results • Modeling decisions 	
<i>Description D</i> Ways in which a model represent the Target R . Verbal, mathematical, diagrammatic, pictorial.	
Target R An actual or possible system.	

Table 5.2, Table 5.3 and Table 5.4 provide summaries of modeling as representation as utilised in this study:

Table 5.2: Modeling as representation - Representative quality

REPRESENTATION QUALITIES	
Representative quality	Representative quality applied to CFFR
Voluntary action by agent <i>A</i> . <ul style="list-style-type: none"> Imagination of ideal situation. Selective choices decided by modeller. 	The researcher is the voluntary agent <i>A</i> in this study. <ul style="list-style-type: none"> The ideal CFFR and idealised assumptions Selective choices were made during the formulation of the idealised assumptions and the four iterations of the CFFR ontology.
Model <i>M</i> stands as surrogate for Target <i>R</i> .	The final model after Iteration 4 is the CFFR ontology as a surrogate for the Target <i>R</i> , the classes and relationships of the financial reporting domain.
Examine Target <i>R</i> indirectly by examining properties and behaviour of Model <i>M</i> .	The Target <i>R</i> is the classes and relationships of the financial reporting domain. The Target <i>R</i> was indirectly examined through the formalisation process consisting of four iterations.

Table 5.3: Modeling as representation - Resemblance quality

REPRESENTATION QUALITIES	
Resemblance quality	Resemblance quality applied to CFFR
Involuntary dimension of Target <i>R</i> . <ul style="list-style-type: none"> Real world Target <i>R</i> to “decide” on properties. 	The real world targets in this study are the classes and relationships of the financial reporting domain and the CFFR itself.
Constraints: <ul style="list-style-type: none"> ontologically – properties of the target; pragmatically – purposes and audiences of modeling. 	<ul style="list-style-type: none"> The first constraint is that the study deals with a social reality that cannot be inspected such as a physical reality. <p>Domain constraints are the properties of the targets. The classes and relationships of the financial reporting domain and the CFFR as a social construct. During the modeling process some incompleteness and implied domain knowledge were detected in these properties.</p> <ul style="list-style-type: none"> The practical purpose is that the model should have a resemblance with the Target <i>R</i> in such a manner that the model would contribute knowledge to the audience regarding the Target <i>R</i>.
Model <i>M</i> must correspond to Target <i>R</i> in suitable respects and in sufficient degrees.	The formal domain ontology of the CFFR must correspond to the Target <i>R</i> sufficiently for domain experts to accept the resemblance.
Resemblance must be genuine in two ways: <ul style="list-style-type: none"> Model <i>M</i> must have a likely capacity to resemble, resemblances must be relevant. 	<ul style="list-style-type: none"> The resemblance of the formal domain ontology CFFR is likely as it is based on the CFFR. The resemblance is relevant as it is analysing and indicating some problems with a document that is used internationally in the financial reporting domain.

Table 5.4: Modeling as representation

REPRESENTATION	
Representation	Representation applied to CFfFR
<i>Pragmatic context X</i> Modeller's purpose, audiences and commentary	The pragmatic context is the drafting of the dissertation for evaluation by supervisors and examiners. The real world context is the financial reporting domain in which a global acceptable CFfFR is needed. The context of the IASB setting and revising the CFfFR.
<i>Purpose P:</i> Epistemic or non-epistemic	
Epistemic function: <ul style="list-style-type: none"> Acquires information of Target <i>R</i> without examining Target <i>R</i> directly. Acquires information of Target <i>R</i> by examining Model <i>M</i> directly. 	<ul style="list-style-type: none"> By examining the CFfFR the information are obtained of the financial reporting domain without examining the actual transactions that should be reported in financial reports. Knowledge are acquired regarding the CFfFR by examining the formal domain ontology of the CFfFR.
Non-epistemic <ul style="list-style-type: none"> Solving a practical problem. Helping in policy-making. 	<ul style="list-style-type: none"> By building the formal domain ontology of the CFfFR a contribution is made towards solving a practical problem as some elements prohibiting the global acceptance of the CFfFR are indicated. The model could help policy-making to improve the CFfFR.
<i>Audience E</i> Users of the model.	The model has different intended audiences i.e. academics, standard setters, supervisors and examiners.
<i>Commentary C</i> <ul style="list-style-type: none"> Modeling results Modeling decisions 	The modeling results and modeling decisions are reported in Chapters 7-9.
<i>Description D</i> Ways in which a model represent the Target <i>R</i> . Verbal, mathematical, diagrammatic, pictorial.	The model is represented verbally, diagrammatic, pictorial and by way of a computer programme.
Target <i>R</i> An actual or possible system.	The Target <i>R</i> is the classes and relationships of the financial reporting domain. The Target <i>R</i> was indirectly examined through the formalisation process consisting of four iterations.

5.2.3 Models as Truth Containers

The third act technique is models and truth. It is best explained by the following questions (Mäki, 2011:58): "What should it be for a model to be true or to contain truths? What is the locus of truth in relationship to models? Where should we look to find it?" In order to find truth in a model the previous two acts techniques of a model, isolation by idealization and models as representations, should be adhered to. According to Mäki (2011) truth can be found in models by adopting a certain pragmatic concept of truth. Two pragmatic properties of truth is proposed by Mäki (2011:58): "...usefulness in regard to a purpose, and persuasiveness in regard to an audience". An important aspect of models and truth according to Mäki (2011) is that "models themselves are not true or false, nor do they contain truths, but true claims can be made *about* models."

How and where will we find truth in the formal domain ontology of the CFfFR? In section 5.2.2, the purpose of the formal domain ontology model of the CFfFR is provided. The purpose of the model is to answer and test the stated research

questions (section 1.3) in order answer the main research question. Should the model contribute towards answering the sub-research questions, the model is useful towards the *Purpose P*, and consequently according to the pragmatic concept of truth, the formal domain ontology of the CFfFR can be viewed as a truth container. The formal domain ontology model can be used to make true claims about the research objectives of this study.

Regarding the second pragmatic property of truth, the persuasiveness of the formal domain ontology in the accounting community is not tested in this study. A concept of proof of Iterations 1, 2, and 3 of the model was accepted for publication in a peer reviewed journal and presented at international accounting conferences (Gerber et al., 2014; Gerber & Gerber, 2011; Gerber, Gerber, & Van der Merwe, 2015). An academic audience can view these two publications as a first step towards persuasiveness of the model. The truth claims of the formal, semantic ontological representation of the CFfFR are indicated during the verification process of the model building process. The third act forms part of the verification stage of the research design.

5.2.4 The Model Formula Applied to the CFfFR

Considering the purpose of the study, the model formula can be applied to the CFfFR from two perspectives. The first perspective is where the CFfFR is the Model *M* and the second is where CFfFR serves as the Target *R*.

In the scenario where the CFfFR is the Model *M*, the model formula could be formulated as follows (Figure 5.5):

Agent *A* is the standard setting body, the IASB, which uses Object *M*, the CFfFR, as a representative of the Target system *R*, the definitions and other fundamental concepts for financial reporting. The Purpose *P* of the CFfFR is to serve as a sound foundation for the development of financial accounting standards that are principle-based, internally consistent and internationally converged. The Agent *A* uses the Model *M*, the CFfFR, to address the Audience *E* that are standard setting bodies, academics and users of financial reports. The CFfFR as Model *M* is prompting genuine issues of resemblance with economic activities of the reporting entity to arise in general purpose financial statements. The IASB applies Commentary *C* on the setting of and explanation of the CFfFR to identify and align these components, all happening within the boundaries of pragmatic Context *X* of the CFfFR's purposes, audiences and the commentary. The CFfFR is primarily described (*D*) by the IASB (agent *A*) in writing in the English language.

Schematically the model formula of the CFfFR can be portrayed as follows:

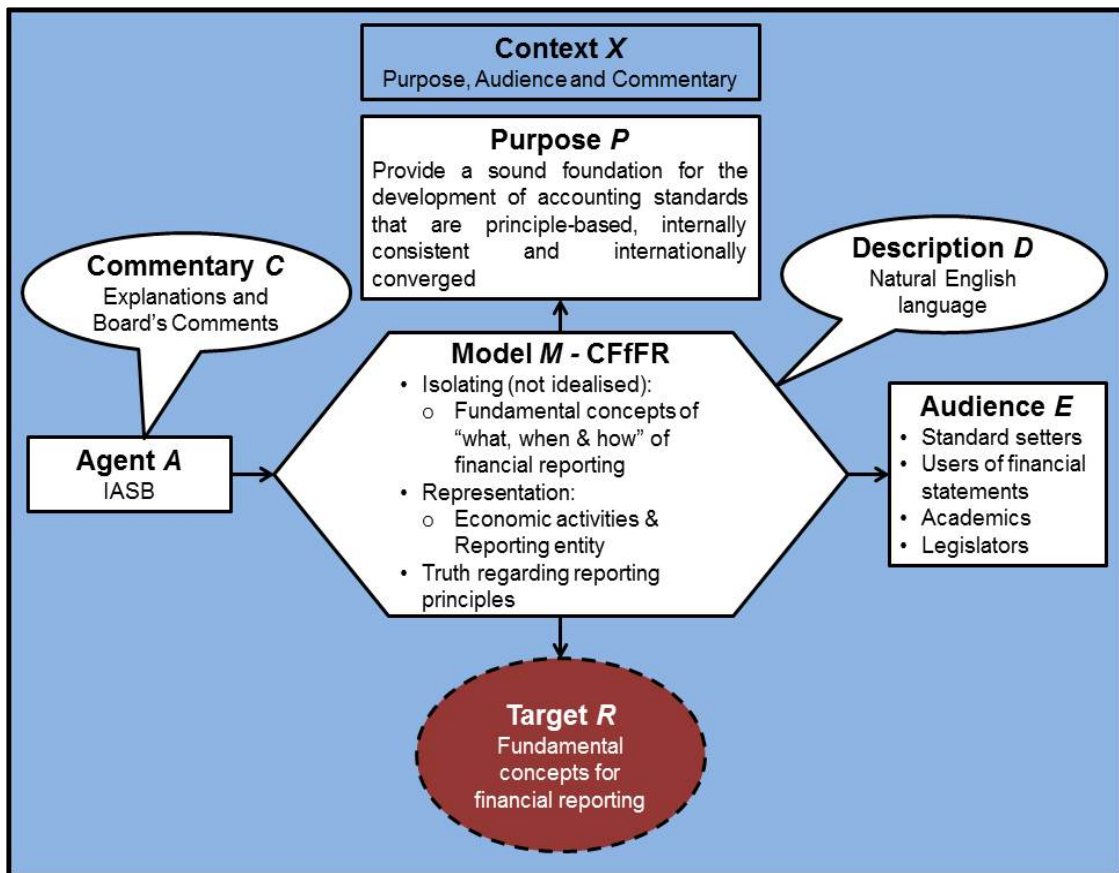


Figure 5.5: Model formula of the CFfFR

Figure 5.6 is a graphic illustration to view the CFfFR as the Target *R* for the formal domain ontology of the CFfFR. The model formula for the second perspective could be formulated as follows:

Agent *A* is the researcher, which uses Object *M*, the imagined formal domain ontology of the CFfFR, as a representative of the Target system *R*, the CFfFR published by the IASB (Figure 5.6). The Purpose *P* of the formal domain ontology is firstly to draft idealised assumptions for a globally accepted CFfFR and secondly to test and report on the role, definition and requirements of the CFfFR. The Agent *A* uses the Model *M*, the formal domain ontology, to address the Audience *E*, mainly academics and perhaps other possible audiences such as standard setters, users of financial statements and legislators. The formal domain ontology as Model *M* is prompting genuine issues of resemblance with CFfFR by translating the written English language into a formal language called Description Logics (DL) and more specific OWL. The researcher applies Commentary *C* when explaining the modeling method, making and explaining modeling decisions and reporting on modeling results and findings. The modeling process is all happening within the boundaries of the pragmatic context *X* of the study's purposes, audiences and commentary. The formal domain ontology is primarily described (*D*) in OWL, which forms part of Description Logic's. The formal domain ontology is also presented in a graphic form using Protégé (Figure 7.30):

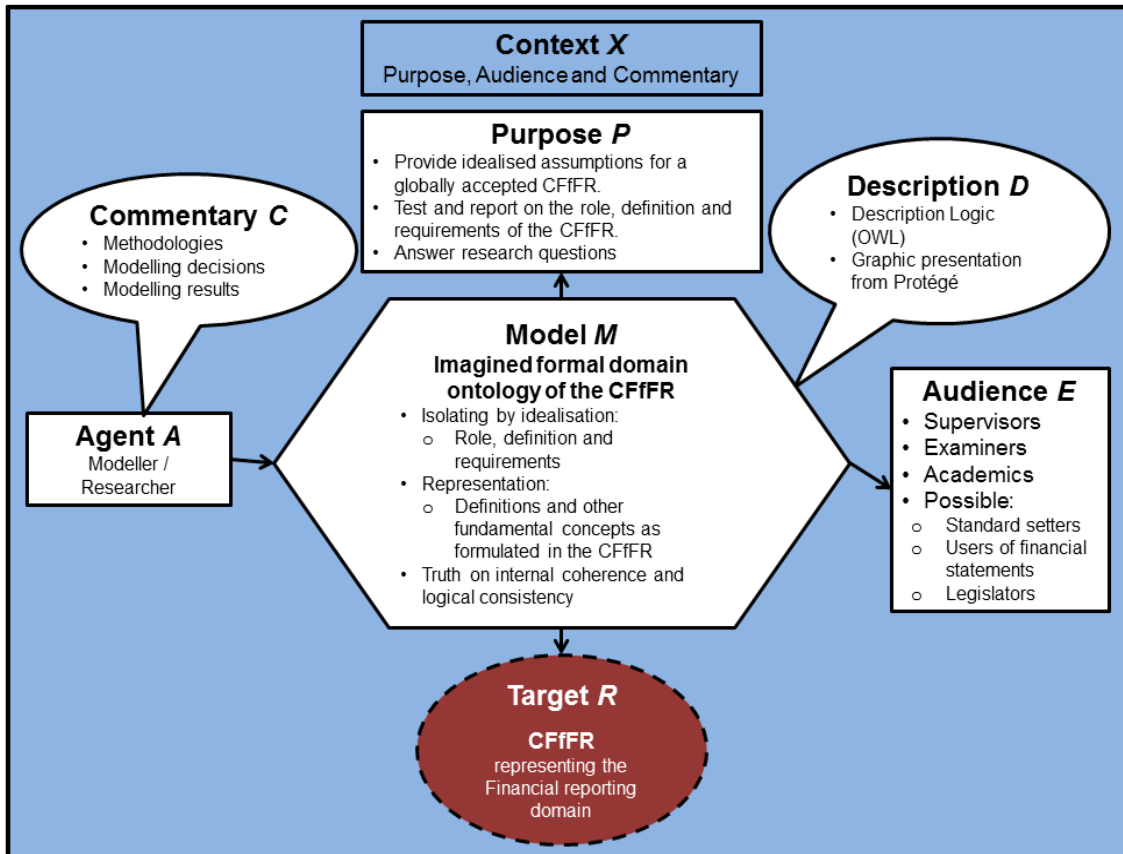


Figure 5.6: Model formula of the formal domain ontology

From the discussion above, using the three act technique and model formula of Mäki (2008; 2009; 2011) and Grüne-Yanoff and Mäki (2014) the value regarding the use of models as truth containers using idealised assumptions for an imagined system to serve as a surrogate for the CFfFR was indicated. In section 5.3, the use of models in computing is firstly explored to determine the idealised role of the CFfFR as a model. Secondly, the applicability of the use of models in computing on accounting is indicated. The model artefact identified in section 5.2 is the identification of an ideal CFfFR as a truth-bearing model of the financial reporting domain.

5.3 Models in Computing

During the 1960s, faulty requirements were identified as a major reason for computer project failures. Information systems developers believed that high-quality conceptual models would detect and correct errors at an early stage. Early detection of errors would avoid the high cost of fixing errors at a later stage (Wand & Weber, 2002). The use of models and metamodels in computing gained credence and are adopted in software engineering standards from the OMG (Object Management Group (OMG, 2014)) and the ISO (International Organization for Standardization (ISO, 2014)) (Henderson-Sellers, 2007). According to Wand and Weber (2002) conceptual modeling involves building a representation of selected phenomena in some domain. When a model is represented as a concrete artefact “it can support communication, learning and analysis about relevant aspects of the underlying domain” (Guizzardi, 2005:XI).

As the purpose of this study is to build a computer readable artefact (formal domain ontology) of the CFfFR, the study adopts the use of the term “model” from software engineering in which “model” refers to an artefact formulated in a modeling language (Kühne, 2005). The underlying domain of this study is the reportable economic activities⁸⁶ of a reporting entity as provided in the CFfFR (see *R* in Figure 5.6). The applicability of the use of “model” from computing is indicated in the statement by Kühne (2005:1) that “all our models are linguistic in nature”. The model artefact of this study is also linguistic in nature as it is presented in OWL, which is a more formal language than natural language.

5.3.1 Definitions and Characteristics of Models in Computing

In section 5.3.1, it is argued that the general ledger, trial balance and financial report of a reporting entity as well as financial accounting standards comply with the definitions and characteristics of models as used in computing. According to Henderson-Sellers (2011b:301) “a model is an abstraction that represents some view on reality, necessarily omitting details, and for a specific purpose.” Kühne (2006b:370) defines a model as “an abstraction of a (real or language-based) system allowing predictions or inferences to be made”.

Ryan et al. (2002), Henderson-Sellers (2011b) and Kühne (2006b) depicts a model as an abstraction of a system or reality. Although abstraction implies the omission of details, it emphasises the characteristic that a model is not a copy⁸⁷ of the reality or the system it represents. Kühne (2006b) describes the reality wider than Henderson-Sellers (2011b) as a system (or original or subject (Kühne, 2006a)) and it can be either a real system (reality⁸⁸ according to Henderson-Sellers (2011b)) or a language-based system. Gonzalez-Perez and Henderson-Sellers (2007:1779) defines a model as “a statement about a given subject under study (SUS), expressed in a given language” and that models represent SUS’s. The SUS refers to the specific domain or system / original / subject (Kühne, 2006a). Apart from the definitions, some characteristics or features of suitable models are provided in the literature regarding models in computing.

For a model to be suitable in computing the abstraction of a given SUS needs to be homomorphic with the SUS and have a specific purpose or usage (Gonzalez-Perez & Henderson-Sellers, 2007; Kühne, 2005). This corresponds with the three features of models according to Stachowiak as presented in Kühne (2005:2):

- **“mapping feature:** A model is based on an original.
- **reduction feature:** A model only reflects a (relevant) selection of the original’s properties.

⁸⁶ In the CFfFR, the terms transactions and events are used. For the purpose of this study, a more comprehensive term is adopted, as it is perceived that the term economic activities are covering all possible activities that could be reported in a financial report. Transactions and events assume some domain knowledge that needs some clarification.

⁸⁷ The difference between a copy and a model is that a copy agrees with an original system / reality in every detail (Kühne, 2005; Kühne, 2006b).

⁸⁸ See the discussion in Gonzalez-Perez and Henderson-Sellers (2007) regarding the difference between a positivistic and relativistic (less positivistic) stance regarding the representation of the structure of reality.

- **pragmatic feature:** A model needs to be usable in place of the original with respect to some purpose.”

From an accounting perspective Ryan et al. (2002:28) states that for a model to succeed in a research programme it should possess the following characteristics:

- “It must be possible to generate theoretical implications from which observational predictions can be drawn.
- The assumptions within the model should be internally consistent in the logical sense and as simple as the logical integrity of the model will permit.
- The model should be theoretically commensurate with any known empirical facts within its domain.
- The model’s theoretical scope is defined by the model and its attendant set of explanatory and predictive implications.
- The combination of a set of related models (related in the sense that they cover the same empirical domain) form, with the relevant observation reports, the literary domain of a particular research programme.”

The characteristic of abstraction or the reduction feature, contributes to the value in the use of a model to enable the users of the model to comprehend and conceptualise a complex system of a specific domain prescribed as the SUS. In financial reporting the specific domain or SUS is the complex system of economic activities to be reported. In order to provide a useful report, an abstraction and aggregation of economic activities are made. As a financial report is a reduction or abstraction of the economic activities of a reporting entity, it complies with the characteristic of abstraction or the reduction feature of a model.

Models must be homomorphic (mapping feature) with the SUS in that the structure of the model should coincide to some degree with the structure of the SUS (Gonzalez-Perez & Henderson-Sellers, 2007). The model should reflect a relevant abstraction of the SUS. This means that the model of a car must resemble the structure of the real car otherwise the model cannot be used to comprehend or communicate information regarding the actual real car.

In the financial reporting SUS, the financial report should reflect a relevant abstraction of the economic activities of a reporting entity to be useful to the users of the financial report. The economic activities are first captured in the general ledger via journals and subsidiary journals and are then summarised in the trial balance. The content of the trial balance is used to compile a financial report. In the end, the financial report should be homomorphic with the economic activities of the reporting entity via the general ledger and trial balance. The general ledger can be viewed as a first model of the economic activities and the trial balance as a second model based on the general ledger, with the financial report a third model based on the previous two. It can thus be concluded that a financial report should be homomorphic with the economic activities of a reporting entity to be useful for the users of the financial report.

The usage of a model is linked to the communicative purpose of a model (pragmatic feature). Guizzardi (2005:XI) links a model to a conceptualisation of a specific domain and states that a represented model “is a medium to preserve and communicate a certain view of the world”.

The definition of Kühne (2006b) allows for the model being used to make predictions or inferences based on a specific model, thus communicating a certain view of the specified domain or SUS. Models are used in a descriptive mode to document existing situations or in a prescriptive mode to document situations that yet have to eventuate (Henderson-Sellers, 2011b; Kühne, 2006b). The descriptive and prescriptive modes of models respectively correspond with what Gonzalez-Perez and Henderson-Sellers (2007) call backward-looking models and forward-looking models of SUS's. A training flight simulator is an example of a backward-looking model of the real airplane and a blueprint of a building is an example of a forward-looking model. The descriptive and prescriptive use of models do not express properties of models and in computing they “are not exclusive and can be combined in different proportions” (Gonzalez-Perez & Henderson-Sellers, 2007:1780).

Apart from the nature of representation (forward or backward-looking) discussed above, Gonzalez-Perez and Henderson-Sellers (2007) discusses which kind of entities are the model and the SUS. Gonzalez-Perez and Henderson-Sellers (2007:1780) conclude that “anything that can be observed can be a SUS, and that a model, once created, becomes part of reality and, therefore, is a potential SUS for further models”.

5.3.2 The Value of Models in Computing

The value of a model is that it enables the users of the model to reason about the SUS (or Target *R*) by looking at the model only (Gonzalez-Perez & Henderson-Sellers, 2007) made possible by the characteristics of abstraction and homomorphism of a model. A represented model “can serve as a vehicle for reasoning and problem solving, and for acquiring new knowledge about this view of the world” (Guizzardi, 2005:XI). The reasoning about the System Under Study (SUS) is made easier because the model is an abstraction of the SUS, performed to fight complexity. Gonzalez-Perez and Henderson-Sellers (2007:1779) summarises the reason for the use of models as follows: “...the major reason that we need models is to reason about the complexity of the SUS without having to deal with it directly”.

According to Wand and Weber (2002) models called conceptual models are used during information systems' requirements analysis development. In information systems, conceptual modeling is modeling applied to cognitive artefacts and designs for software systems (Henderson-Sellers, 2011a). Conceptual models “are used to represent both static phenomena (e.g., things and their properties) and dynamic phenomena (e.g., events and processes) in some domain” (Wand & Weber, 2002:363) and uses graphical representations (Henderson-Sellers, 2011a). Graphical representations serve to simplify and standardise complex SUS's in order to enhance the communication ability of a model to different users. Wand and Weber (2002) stated that conceptual models in computing serve at least four purposes:

(1) communication between developers and users, (2) assist analysts to understand the domain, (3) provide input in the design process, and (4) document requirements for future reference. According to the pragmatic feature, a model provides information on something (content of the SUS), created by someone (the sender), for somebody (the users) for a purpose (certain use within the domain context) (Kühne, 2005). Considering the pragmatic feature of models, the effective and unambiguous communication ability of the model regarding the SUS, it determines the value of the model to the various users of the model.

5.3.3 Computing Models Applied to Accounting

In terms of accounting, it means that economic activities serves as the SUS for the general ledger and the general ledger serves as a System Under Study (SUS) for the trial balance and the trial balance serves as a SUS for the financial report. If we consider the financial report of a reporting entity as a model representing a certain perspective of the economic activities of the reporting entity (SUS), the financial report can then serve as a SUS of a further model. As a financial report of a reporting entity is used to describe the economic activities of an entity, it serves to analyse and predict (prescribe) future economic activities to make economic decisions. It can thus be concluded that a financial report as a model has a descriptive and prescriptive use.

As the “objective of general purpose financial reporting is to provide financial information about the reporting entity that is useful to existing and potential users” (IASB, 2010a:OB2), the informative function of a financial report seems to be of great importance. If we apply the informative function according to the pragmatic feature of a model on the financial report of a reporting entity, it can be stated that a financial report complies with the pragmatic feature of a model in that a financial report:

- provides information on the economic activities of a reporting entity (content of the SUS);
- is created by the directors of the reporting entity (the senders), and verified by external auditors;
- provides financial information about the reporting entity to “existing and potential investors, lenders and other creditors” (IASB, 2010a:OB2) (the users);
- provides financial information that is useful for decision making by the users of the financial report (certain use within the domain context).

From the discussion above it can be concluded that a general purpose financial report adheres to the definitions, characteristics and features of models as utilised in computing.

In general, a distinction is made between non-linguistic or iconic and linguistic models (Henderson-Sellers, 2011b). Linguistic models, based on a language-based system, are more commonly used in computing. Linguistic models are models made up of words providing semantic meaning. A financial report will classify as a linguistic model. Kühne (2005:1) differentiates between “two fundamentally different kinds of models, i.e. ‘type model’ versus ‘token model’”.

5.3.4 Financial Reporting as Type and Token Models

Token models are used for capturing system configurations and are used as the basis for simulations. Examples of token models are maps and building plans for houses. Singular aspects of the original's elements are captured with a token model. Token models are also referred to as snapshot models as they capture only a single configuration of a complex system (Kühne, 2005). The building plan of the northern face or foundations of a building provide a snapshot of specific elements of the planned building. When the "represented_By" relationship between the original and the model is transitive, then the model is a token model (Kühne, 2005).

Type models collect concepts and their universal object properties to *classify* objects and *draw conclusions* based on the collection. The universal aspects of an original's (SUS) elements are captured in a type model (Kühne, 2005). The difference between a type model and a token model is that a type model only shows the types of interest while the token model shows all the particular elements and their relationships. A type model is also called a "schema model" or a "classification model". In terms of accounting, a general ledger is showing all the particular elements of the financial transactions (not all the economic activities) of an entity and their relationships grouped together, thus making it a token model. The relationship between a type model and the SUS is described as a "classified_By" relation (Figure 5.7).

A trial balance is also a token model as it is only a "map" with less detail of the original financial transactions, a summary of the general ledger. Financial reports are type models as they provide a classification of the universal properties of the economic activities (original elements) of the reporting entity based on certain guidelines provided in financial accounting standards. Financial reports are more than just a summary of transactions like for example a trial balance, they provide more information than a pure summary of the transactions. Financial reports contain a lot more additional information regarding the economic activities of a reporting entity than only a summary representing the basic accounting transactions. One example of such a conclusion in a financial report is a statement of cash flows.

At this stage, it might be tempting to call a trial balance a metamodel of the general ledger making the financial report a meta-metamodel. According to Kühne (2005:6) "a token model of a token model is not its metamodel" as the second token model is still a representation, a map derived from a finer map of the original elements. A financial report (type model) is also not a metamodel of a trial balance (token model), as the financial report is the first type model of the original elements (economic activities). Kühne (2005:7) states clearly that when a type model is a model of a token model it is "inappropriate to call it a metamodel since both are models of the original".

A schematic illustration of the model relationships between the SUS, general ledger, trial balance and financial statement is provided in Figure 5.7:

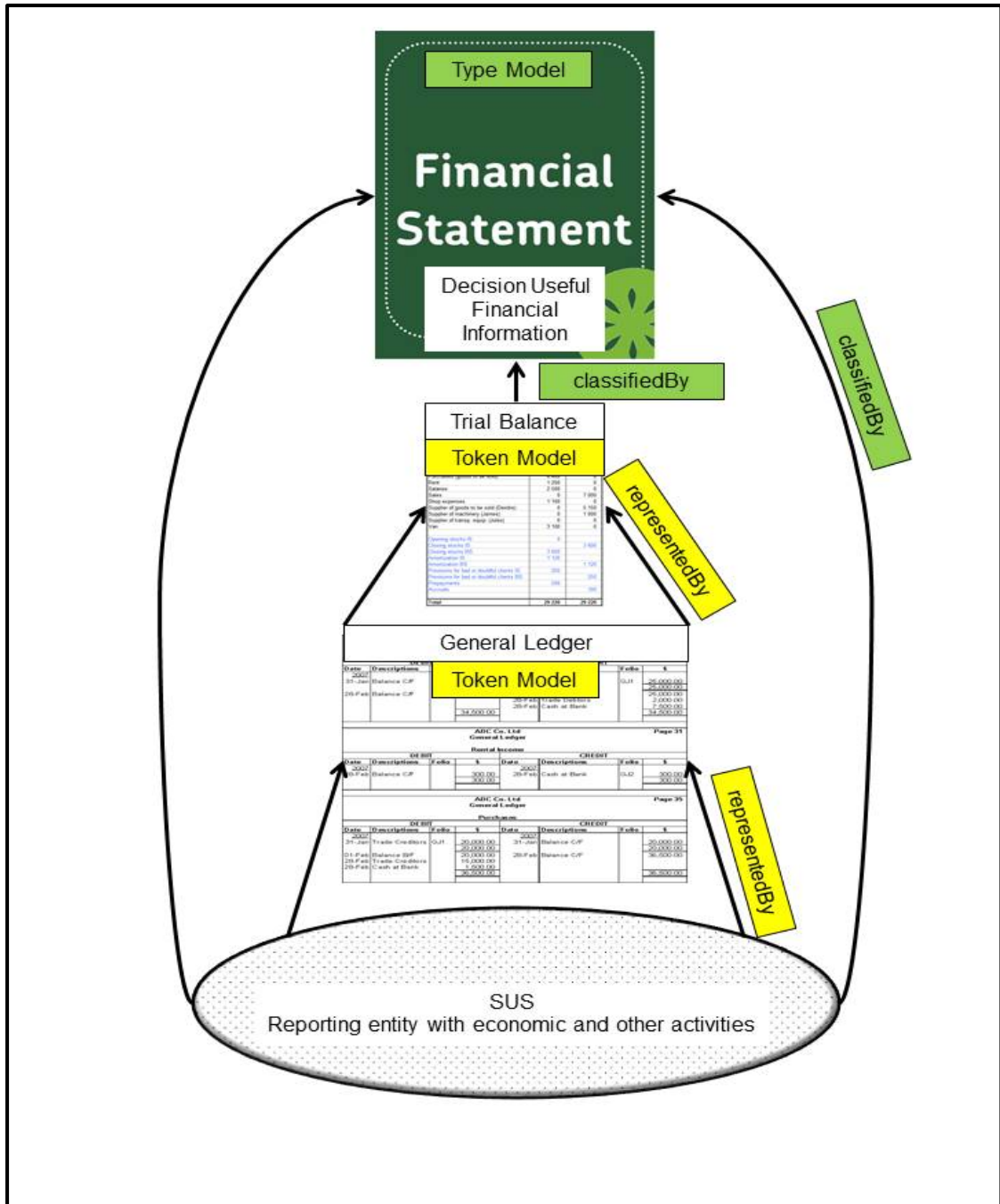


Figure 5.7: Financial reporting basic token, type model relationship

It can be argued that financial accounting standards can also be viewed as models if the requirements of the definition, features and characteristics of a model in computing are applied to financial accounting standards. A financial accounting standard provides the principles and rules of what, when and how to recognise, classify, measure and disclose economic information. In terms of the model definition, the principles and rules are a description of the object properties of the original reality (SUS) (Kühne, 2005) for example universal object properties of all fixed asset transactions, or the accounting treatment of all financial instrument transactions documented in the respective accounting standards. The universal properties (principles and rules) provide an abstraction and classification of the object properties that represent a specific view (standardised by a standard setting body) of how the original system e.g. fixed asset transactions should be communicated. The abstraction (financial accounting standard) allows for predictions or inferences to be made (Kühne, 2005) as the purpose of financial accounting standards is to guide the recognition, classification, measurement and disclosure of economic activities.

As a financial accounting standard complies with the definition of a model, it can be argued that a financial accounting standard is suitable to function as a model in computing. It can also be argued that a financial accounting standard also adheres to the three characteristics and features of a model in computing (abstraction and reduction, homomorphic and mapping, purpose and pragmatic) (Gonzalez-Perez & Henderson-Sellers, 2007; Kühne, 2005). A financial accounting standard is an abstraction of the universal object properties of the original economic activities, thus complying with the reduction feature of a model. A financial accounting standard only reflects a relevant selection of the object properties.

As a financial accounting standard provides the universal object properties of a specific class of economic activities e.g. fixed assets (IAS16), that specific accounting standard (IAS16) is homomorphic with the SUS (fixed asset economic activities). It can then for example be argued that IAS16 complies with the mapping feature of the original SUS. Financial accounting standards complies with the pragmatic feature of a model in that their purpose is to communicate the principles and rules regarding the recognition, classification, measurement and disclosure of the economic activities of a reporting entity. It can be concluded that financial accounting standards comply with the definition(s), characteristics and features of a model as provided by computing.

Comparing the characteristics and features of financial accounting standards viewed as models to Kühne's (2005) two types of models it can be argued that financial accounting standards are type models based on their relationship to the original system (SUS). A type model, and in this case financial accounting standards, captures the universal aspects of the original system (SUS) (Kühne, 2005) i.e. the economic activities of a reporting entity. The object properties of the original economic activities are "classified_By"⁸⁹ financial accounting standards Figure 5.8.

⁸⁹ "classifiedBy" is used by Kühne (2005) to describe the relationship between the original and a type model.

According to Kühne (2005:7) it is also possible “to model the properties of a token model itself instead of its content”. Based on this possibility it can be argued that financial accounting standards can be classified as a type model of the properties of the other two token models in the system i.e. the general ledger and the trial balance.

When Figure 5.7 is expanded to accommodate financial accounting standards in the model relationship it can schematically be portrayed as follows in Figure 5.8:

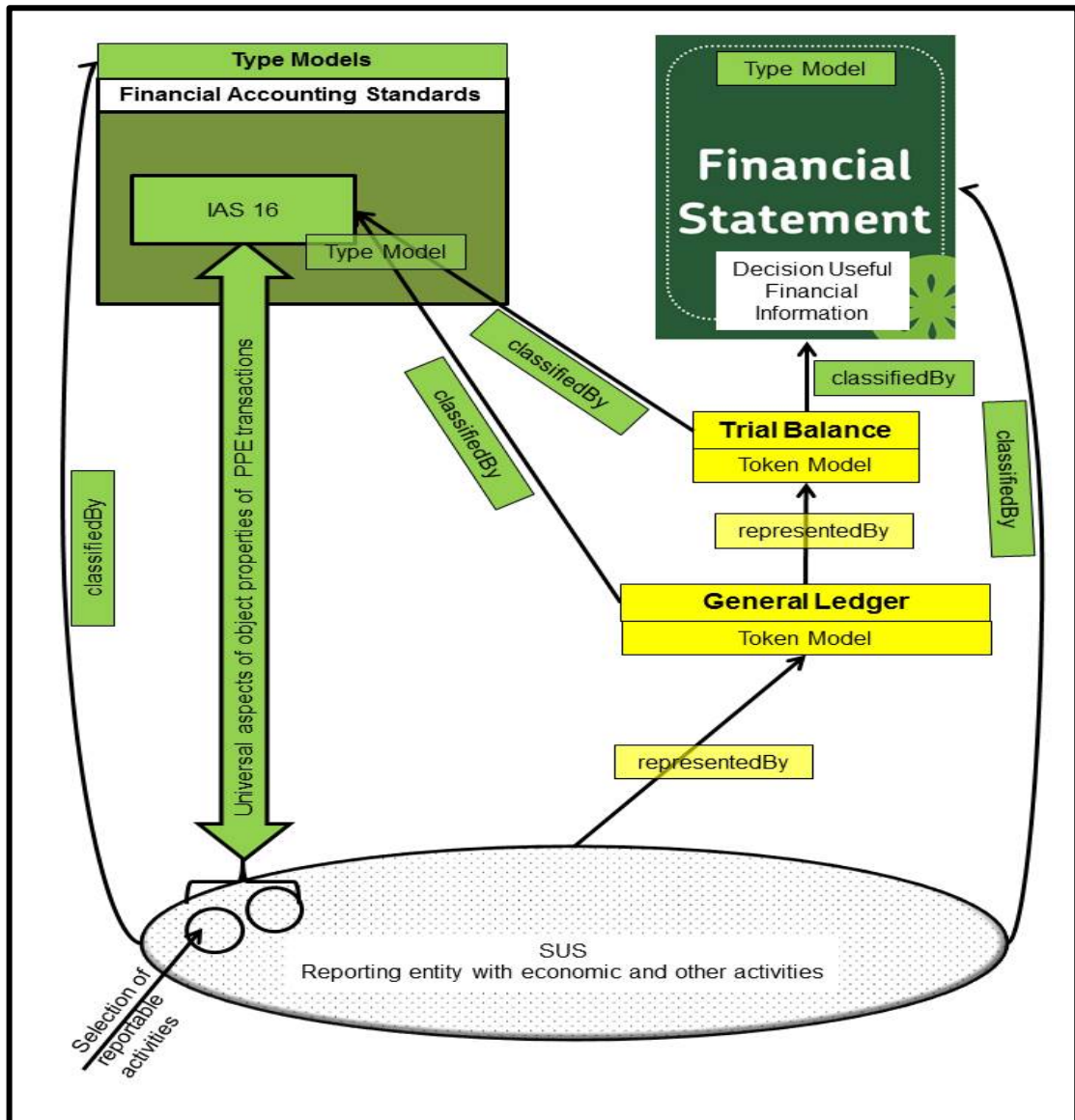


Figure 5.8: Financial reporting token, type model relationship including financial accounting standards

Figure 5.8 illustrates the model relationship role of financial accounting standards towards economic activities as `classified_By`. Financial accounting standards also have a `classified_By` relationship towards trial balance and general ledger, as both the trial balance and the general ledger are token models.

In section 5.3.5, the use of metamodels and meta-metamodels in computing and its application in accounting is discussed.

5.3.5 Metamodels and Meta-metamodels Applied to the CFfFR

According to Henderson-Sellers (2007) a metamodel is a model of a set of models. This means that a model is an instance of a metamodel (Kühne, 2006b). According to the homomorphic characteristic of models there is “a one-to-many relationship between any element in a metamodel to corresponding elements in the model” (Henderson-Sellers, 2011b:302). The implication of the homomorphic characteristic of models is that “a model is said to conform to its metamodel when each element in the model maps to a corresponding and definitional element in the metamodel” (Henderson-Sellers, 2011b:302). Regarding the abstraction characteristic of models, “a metamodel describes a domain that is representative of more than one instance in a less abstract domain (i.e. it is a model of models) and, at the same time, it is the core of a modeling language used to describe those instances” (Henderson-Sellers, 2011b:302).

Regarding the relationship between metamodels, classes and SUS’s “a metamodel is a specification model for a class of SUS where each SUS in the class is itself a valid model expressed in a certain modeling language” (Henderson-Sellers, 2007:3). Gonzalez-Perez and Henderson-Sellers (2007:1780) conclude that “anything that can be observed can be a SUS, and that a model, once created, becomes part of reality and, therefore is potential a SUS for further models”. A true metamodel is created when a classification of the same SUS are repeated twice i.e. a type model is produced from a type model (Kühne, 2005) (Figure 5.9). “Metaness” involves a detachment from the original. It is a two level detachment of the original (Kühne, 2006b).

Henderson-Sellers (2011b) provides a four level hierarchy of the OMG architecture regarding the relationship between data, models, metamodels and meta-metamodels. The four level hierarchy of the OMG is adopted and adjusted from Henderson-Sellers (2011b) as Figure 5.9.

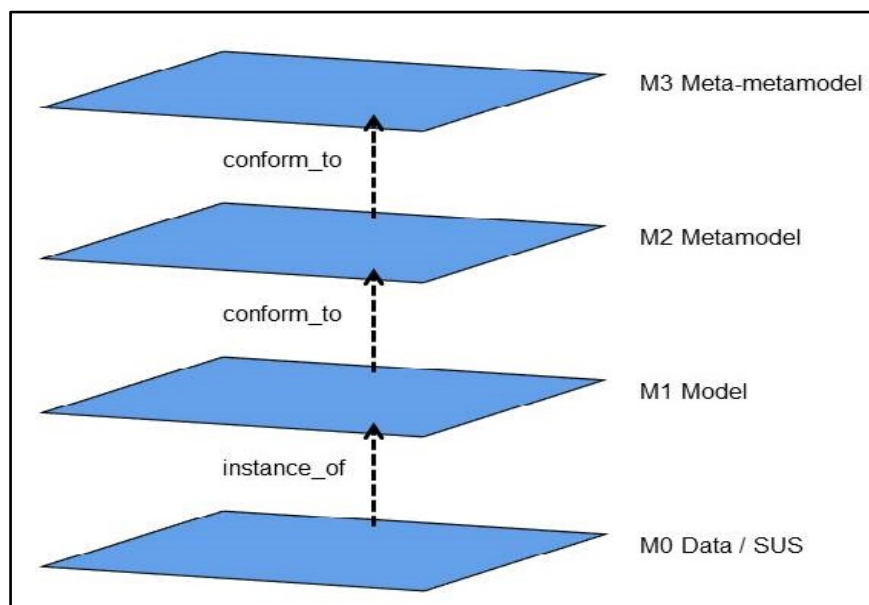


Figure 5.9: OMG four level hierarchy adjusted

It can be argued that, in connection to general purpose financial reports, financial accounting standards has a “classified_By” relationship in that it is prescriptive in terms of principles and rules on what, when and how to recognise, classify, measure and disclose economic information in the financial report (Figure 5.10). A conformance relationship exists between the different model levels. According to Henderson-Sellers (2011b:302) “a model is said to conform to its metamodel when each element in the model maps to a corresponding and definitional element in the metamodel.” According to the four level hierarchy, it can be argued that general-purpose financial reports (M1) “conform_to” financial accounting standards (M2) and the economic activities (M0) are an “instance_of” of general-purpose financial reports. A general purpose financial report (M1) serves as a SUS for financial accounting standards in that it is a model and forms part of the reality of the financial reporting domain (Gonzalez-Perez & Henderson-Sellers, 2007). The relationship between financial accounting standards and a general-purpose financial report is a type model of a type model thus making the financial accounting standards a metamodel (M2) of a general-purpose financial report. In order for a general-purpose financial report (M1) and financial accounting standards (M2) to have a metamodel relation, each element in the general-purpose financial report must “conform_to” a corresponding and definitional element in the accounting standards.

If the four level hierarchy of the OMG is applied to the schematic model relationship between the economic activities (Figure 5.8), a general-purpose financial report and financial accounting standards can be presented in Figure 5.10.

Figure 5.11 illustrates the model relationships if the CFfFR is added.

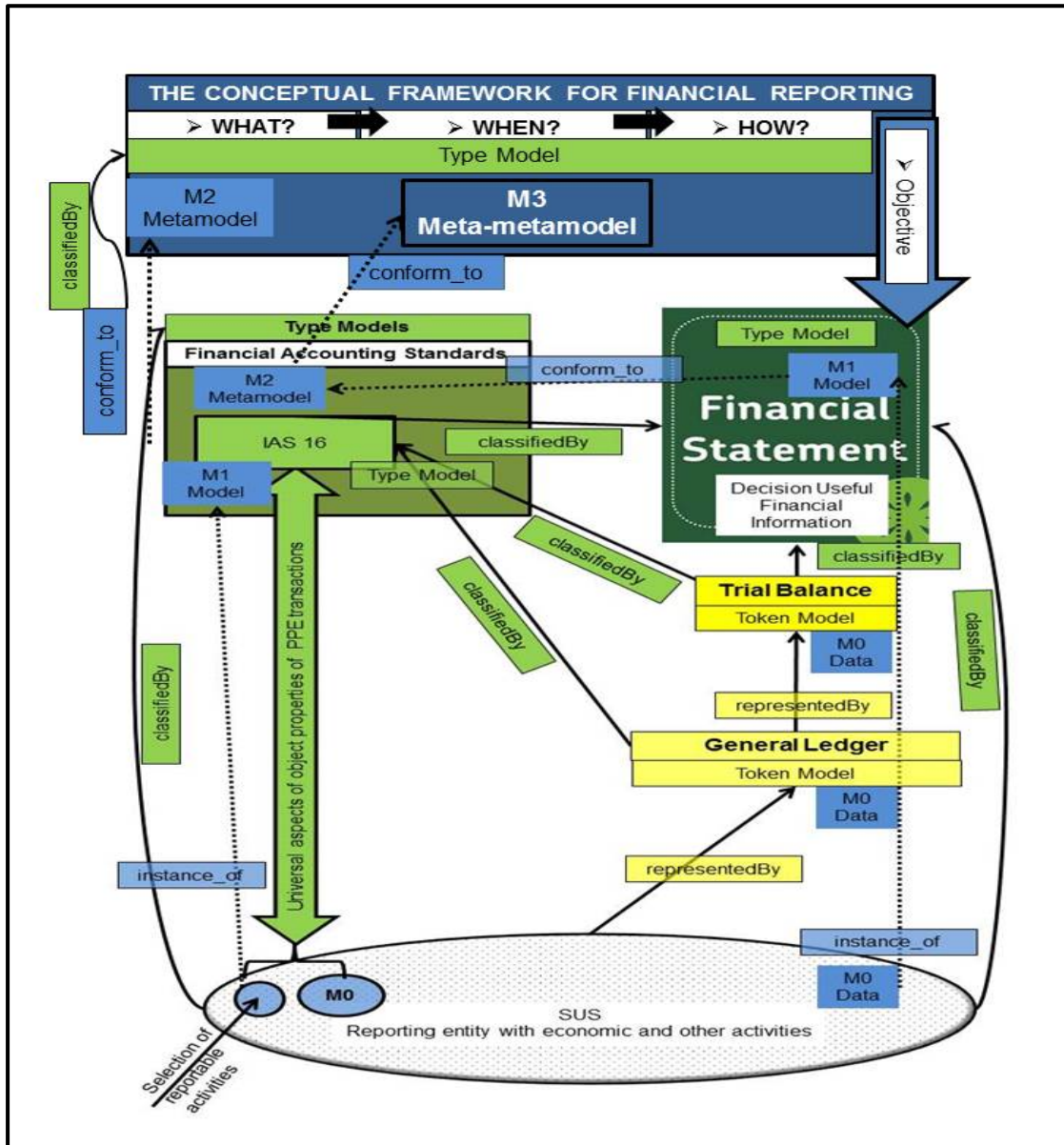


Figure 5.11: CFfFR as meta-metamodel in the four level hierarchy

It can be argued that the relationship of the CFfFR towards the economic activities via financial accounting standards is a type model *classifiedBy* a type model making the CFfFR a metamodel in relationship to the economic activities (Kühne, 2005; Kühne, 2006b). If it is accepted that financial accounting standards (M1) represent more than one instance (economic activities (M0)) in a less abstract domain and the CFfFR describes the financial accounting standards (SUS) domain in a less abstract domain (a model of a model), then the CFfFR can be classified as metamodel (M2) in relationship to financial accounting standards (Gonzalez-Perez & Henderson-Sellers, 2007; Henderson-Sellers, 2011b) (Figure 5.11).

It can also be argued that the relationship of the CFfFR towards the economic activities, via financial accounting standards and via a set of general-purpose financial statements, is a meta-metamodel relation. The economic data SUS (M0,

data and 2 token models) is an *instance_of* the general-purpose financial statements SUS (M1, type model). The general purpose financial statements SUS (M1, type model) is an *instance_of* the financial accounting standards SUS (M2, type metamodel). Lastly financial accounting standards SUS (M2, type metamodel) is an *instance_of* the CFfFR (M3 Meta-metamodel) (Gonzalez-Perez & Henderson-Sellers, 2007; Henderson-Sellers, 2011b).

It was argued in section 5.3.5 that the CFfFR adheres to the definition and characteristics of a token metamodel and token meta-metamodel of the SUS of economic activities in the financial accounting reporting domain.

The three characteristics and features of a model in computing (abstraction and reduction, homomorphic and mapping, purpose and pragmatic) (Gonzalez-Perez & Henderson-Sellers, 2007; Kühne, 2005) corresponds with the requirements and characteristics of a conceptual framework for accounting as described in section 4.6 and as illustrated in Figure 4.6. A conceptual framework is by nature an abstraction or reduction of the reality it is representing and describing. The complete, comprehensive and logically consistent requirements of a conceptual framework correspond with the homomorphic and mapping characteristic of a model.

Figure 5.12 provides a schematic illustration of the OMG four level hierarchy applied to the model relationships in financial reporting.

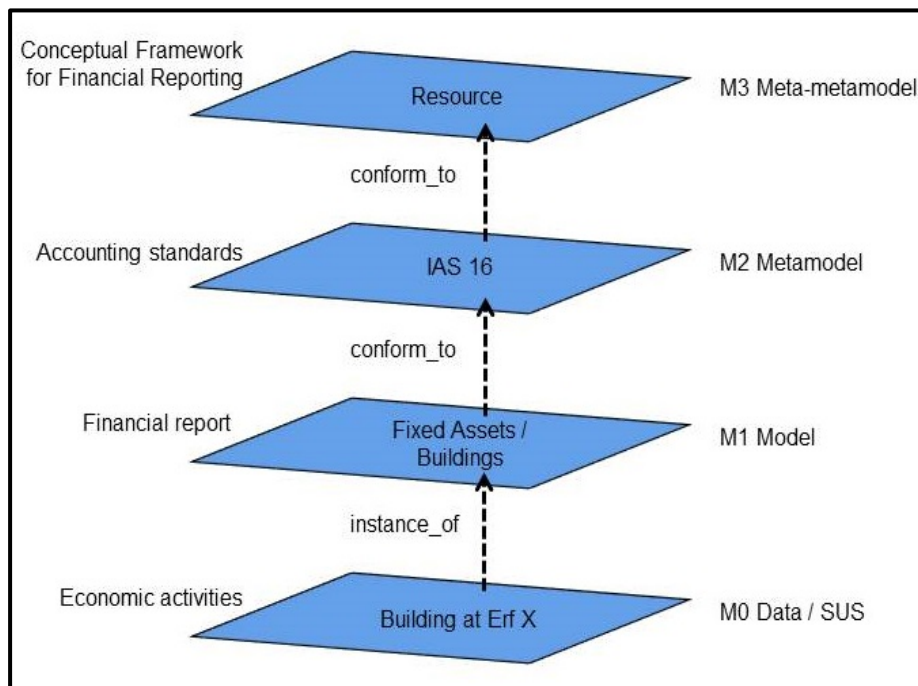


Figure 5.12: OMG four level hierarchy applied to financial reporting models

Using the example of a specific building at Erf X registered in the name of a reporting entity, the relationships can be explained as follow: The specific building at Erf X forms part of the economic activities of the reporting entity and can be classified at level (M0). The building (a specific individual occurrence) is an *instance_of* the category fixed assets, sub category buildings in the financial report (Model M1) of the

reporting entity. The fixed assets, sub category buildings conform to the prescriptive specifications in accounting standard IAS16 at metamodel level (M2). The specific building at Erf X conform to the concept resource at the meta-metamodel level (M3) via levels (M1) and (M2). IAS16 at metamodel level (M2) must conform to the concept resource a corresponding and definitional element at the meta-metamodel (M3) to have a homomorphism relationship with level (M3). If that relationship is true, then the CFfFR is successful in its purpose to provide postulates and principles ensuring useful information to the users of financial reports.

The purpose or pragmatic characteristic of a model is to communicate information, which corresponds with the objective of the CFfFR to provide guidance for decision-useful financial information. The success of the pragmatic characteristic of the ideal or global CFfFR as a meta-metamodel to communicate information depends on the requirement to be clear and unambiguous.

By determining the ideal role of the ideal or global CFfFR as a meta-metamodel within the financial reporting domain, SRQ 1 is answered (Table 3.2). The ideal role of the ideal and global CFfFR as a meta-metamodel justifies the use of ontology technologies in building a CFfFR ontology and contributes towards answering SRQ 2.⁹⁰ Figure 5.12 is a schematic illustration of the model artefact of the ideal CFfFR. The role CFfFR as a meta-metamodel serves as an evaluation point in the FEDS Human Risk & Effectiveness evaluation strategy (Figure 3.11).

In computing, ontologies are used as a tool to formalise models to test the internal coherency, logical consistency and clear communication of models. In section 5.4, some idealised assumptions for the CFfFR are derived from the application of model theories to isolate the ideal imagined CFfFR.

5.4 Idealised Assumptions

A result of DSR Cycle 2 was to view the CFfFR as a truth bearing ideal model for financial reporting (Mäki, 2011) (Figure 5.6). Chapters 2 and 4 were revised for idealised assumptions after the truth bearing ideal model was accepted in Chapter 5. The following preliminary idealised assumptions are assumed in order to create a truth bearing formal ontological domain model of the ideal CFfFR.

5.4.1 Idealised Assumptions Identified in Chapter 2

The following idealised assumptions regarding the ideal CFfFR were identified in Chapter 2 after adopting the truth bearing model theory of Mäki (2011).

1. A globally accepted conceptual framework for financial reporting is possible.
2. The semantic domain modelled in this study is the definitions and other fundamental concepts providing guidance for globally acceptable financial reporting.

⁹⁰ How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

3. The ideal CFfFR provides all the definitions and other fundamental concepts needed to guide standard setters to set high quality principle-based globally acceptable accounting standards.
4. The ideal CFfFR is not the result of responses to economic, technological, political or legislative stimuli.

5.4.2 Idealised Assumptions Identified in Chapter 4

The following idealised assumptions regarding the ideal CFfFR were identified in Chapter 4 after adopting the truth bearing model theory of Mäki (2011).

5. Existing accounting standards do not influence the formulation of definitions and other fundamental concepts in the conceptual framework.
6. There are no political influences and regulatory prescriptions on creating the ideal CFfFR.
7. The ideal CFfFR satisfies the needs of practitioners, requirements of legislators, and theories of academics.
8. The ideal CFfFR is internally coherent and logically consistent.
9. The conceptual framework is free of unintended meanings. The ideal CFfFR is clearly formulated and can communicate across cultures (section 6.2.3).

5.4.3 Idealised Assumptions Summarised from Models and Financial Reporting in Chapter 5

The following idealised assumptions regarding the ideal CFfFR were identified in Chapter 5 after adopting the truth bearing model theory of Mäki (2011).

10. The definitions and other fundamental concepts in the conceptual framework are limited to the definitions and other fundamental concepts to guide the setting of principles to provide information needed by primary users of general-purpose financial statements to make decisions.
11. The ideal CFfFR serves as a meta-metamodel, has a deductive role towards accounting standards and consequently, has a strictly prescriptive status towards accounting standards.
12. Definitions of the elements of financial statements and other fundamental concepts are applied both inductively and deductively to economic instances. Regardless of the direction of application of the definitions and fundamental concepts, the same results are arrived at.
13. Given the deductive role of the ideal conceptual framework, accounting standards are logically and internally consistent with the ideal conceptual framework.

The idealised assumptions provide the vocabulary and conceptualisation of the characteristics and assumptions of a CFfFR that could be globally acceptable. These assumptions serve as a construct artefact of DSR Cycle 2. By formulating the ideal assumptions of an ideal and global CFfFR, SRQ 2 is answered as it is indicated how model building could contribute towards constructing a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged

5.5 Knowledge Contribution

The strategy towards building the formal domain ontology of the CFfFR as the main artefact in DSR Cycle 4 was advanced during DSR Cycle 2 with the addition of three more artefacts (Table 3.1). The three artefacts, the notion of an ideal CFfFR, the role of the ideal CFfFR as a meta-metamodel, and the ideal assumptions of an ideal CFfFR are contributing towards knowledge on how to build a CFfFR that could be globally acceptable. These artefacts represent evaluation markers on the FEDS Human Risk & Effectiveness evaluation strategy. The progress on the FEDS Human Risk & Effectiveness evaluation strategy is schematically illustrated in Figure 5.13.

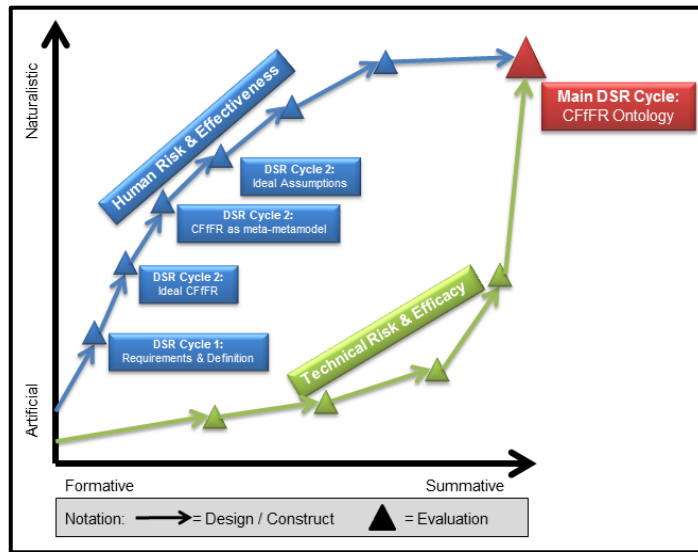


Figure 5.13: FEDS Strategy - DSR Cycle 2

5.6 Conclusion

During DSR Cycle 2 the role of the CFfFR as an unrealistic ideal truth-bearing model was established (Figure 5.6) using a model theory from philosophy of science as explained by Mäki (2009; 2011). The first artefact of the Development Step was to define the role of the ideal CFfFR as a truth-bearing model, thus answering the first sub-research question.

From a model perspective in computing the OMG four level hierarchy (OMG, 2008; OMG, 2014) was adopted and adapted and applied to the financial reporting domain (Figure 5.12) to determine the ideal role of the CFfFR as a meta-meta type model for the financial reporting domain (Figure 5.10) as described by Kühne (2005; 2006b; 2006a). The argument to view the ideal CFfFR as a meta-metamodel is the second artefact of DSR Cycle 2 and provides the theoretical background to answer the second sub-research question.

Based on the model theory of Mäki (2009; 2011) Chapters 2, 4 and 5 were investigated to develop the third artefact of DSR Cycle 2 i.e. to develop the ideal assumptions regarding the ideal CFfFR that would be globally acceptable. The idealised assumptions provided in section 5.4 contribute towards the requirements of a global CFfFR adding to the requirements determined in Chapter 4.

The knowledge contributions of DSR Cycle 2 stimulated the need to investigate the use of ontologies in other disciplines and apply that knowledge to the ideal CFfFR as a meta-metamodel.

In Chapter 6, (section 6.2) the philosophical background of ontology(ies) is discussed and the applicability of ontologies as used in computing on the financial reporting domain (section 6.3) is explored. In Chapter 6, the theoretical motivation to build a formal upper domain ontology of the CFfFR is completed and the second sub-research question answered.

CHAPTER 6

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6 ONTOLOGIES AND FINANCIAL REPORTING

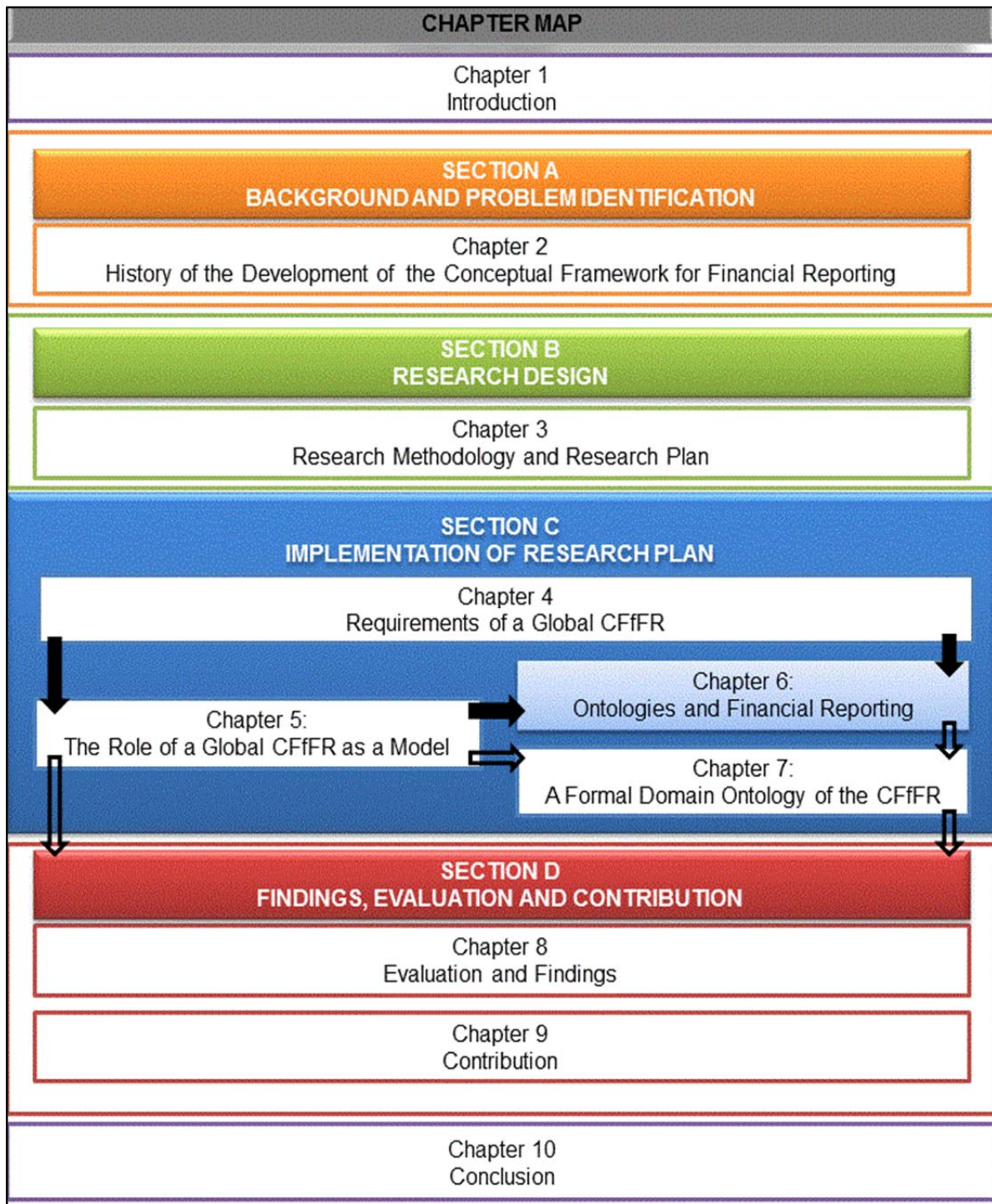


Figure 6.1: Chapter map - Chapter 6

6.1 Introduction

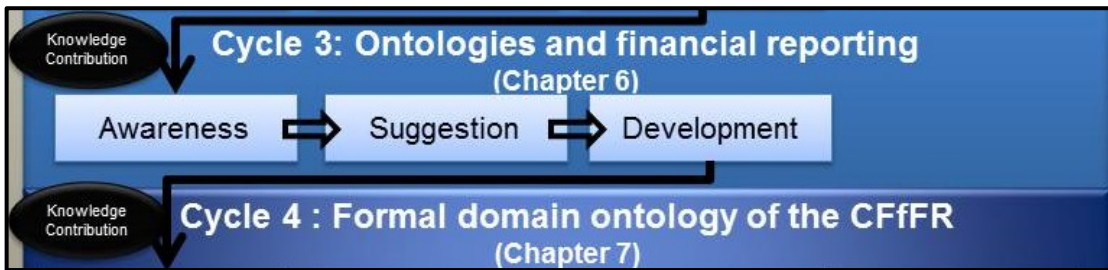


Figure 6.2: DSR Cycle 3

The purpose of Chapter 6 is to argue the relevance of ontology from a philosophical perspective and the use of formal domain ontology technologies in computing⁹¹ for this study. Chapter 6 reports on the third DSR Cycle (Figure 3.3 and Figure 6.2). The Awareness Step of DSR Cycle 3 flows directly from the knowledge contribution of DSR Cycle 2. The ideal role of the CFfFR as a meta-meta token model based on the idealised assumptions stimulated the need to determine the possibilities provided by ontologies. An overview of the structure of Chapter 6 is provided in Figure 6.3.

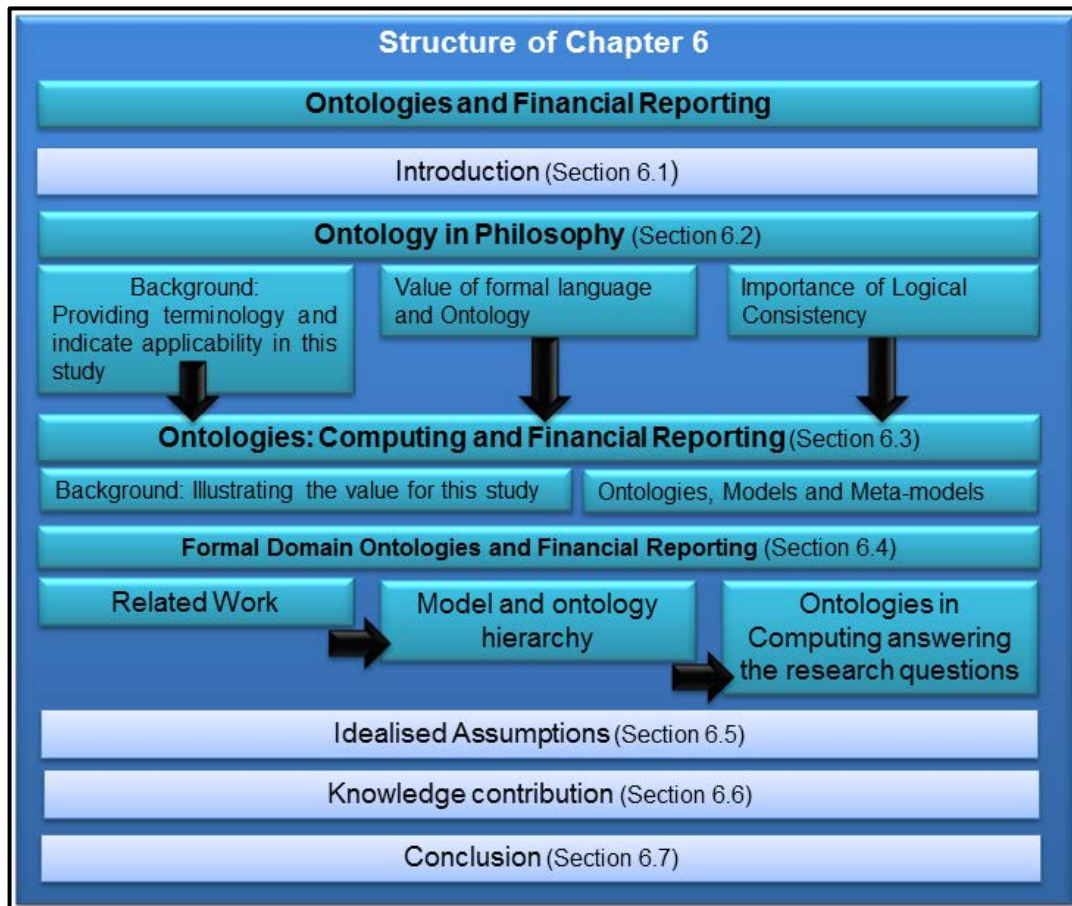


Figure 6.3: Structure of Chapter 6

⁹¹ Computing is used to refer to both Computer Sciences and Information Systems.

In the Suggestion Step of DSR Cycle 3, it was proposed to conduct an interdisciplinary investigation into the applicability of ontologies from a philosophical and a computing perspective to the ideal CFfFR. The applicability of ontology as discipline was firstly argued from a philosophical perspective. During the Development Step of DSR Cycle 3, the discussion on the applicability of ontology from a philosophical perspective involved a short background on ontology as discipline (section 6.2.1), the use of formal language (section 6.2.2) in ontology and the importance of logical consistency for the acceptance of theories across different cultures (section 6.2.3).

Secondly, formal domain ontologies as utilised in computing were explored for applicability in this study. The use of ontologies in computing forms the background of section 6.3. Related work on ontologies in financial reporting is discussed in section 6.4.1 in order to position the research conducted in this study. Before the possible application of formal ontology technologies on the CFfFR (Target domain R , Figure 5.6), is explored, the link between ontologies, models and meta-models is discussed in section 6.4.2. Section 6.4.2 serves as the link between section 5.3 and Chapters 6 and 7. The first output (a model artefact, Table 3.1) of the Development Step of DSR Cycle 3 is the role of the ideal CFfFR as formal domain ontology based on the OMG four level hierarchy (Figure 6.6). In section 6.4.3 formal domain ontologies as utilised in computing is applied to the financial reporting domain. The second artefact is a construct on how a CFfFR ontology could contribute towards answering SRQ 3.

Thirdly, an overview on accounting ontologies related to this work is provided in section 6.4. In section 6.4 it is indicated that at the time this study was conducted no other work was identified building a formal domain ontology of the CFfFR. In the related work section, the need for a formal domain ontology of the CFfFR was confirmed. In section 6.6, the role of the output artefacts in DSR Cycles 1, 2, and 3 in the FEDS Human Risk & Effectiveness evaluation strategy is discussed. Chapter 6 concludes with a summary of idealised assumptions for a global CFfFR derived from Chapters 4, 5 and 6.

With the execution of DSR Cycle 3, the third sub-research question of how the formalisation the CFfFR could assist in constructing a CFfFR that logically formalise fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged, is answered.

In Chapter 7, the formal domain ontology of the CFfFR is constructed using the background information provided in Chapters 4, 5, and 6, thus answering the main research question during the execution of DSR Cycle 4.

6.2 Ontology in Philosophy

6.2.1 Background on Ontology in Philosophy

Ontology is an interdisciplinary study involving philosophy and science (Grenon & Smith, 2009; Losee, 2001; Zúñiga, 2001). Ontology as discipline does not exist independently from other scientific disciplines, it obtains the structure of the world as it really is from knowledge embodied in other disciplines and depends on the language of other disciplines (Corazzon, 2013; Smith, 2003). In applying ontology one selects the most important and most general laws from the various disciplines at a specific time (Corazzon, 2013; Corazzon, 2010; Smith & Ceusters, 2005). The ontologist interprets and generalises the most fundamental and general structures of a discipline (Wolterstorff, 1970).

Ontology⁹² is defined in the Mirriam-Webster Dictionary (2014) from a philosophical perspective as:

- 1: “a branch of metaphysics concerned with the nature and relationships of being;
- 2: a particular theory about the nature of being or the kinds of things that have existence”.

According to Smith (2003:155) “ontology as a branch of philosophy is the science of what is, of the kinds and structures of objects, properties, events, processes and relationships in every area of reality” and is often used as a synonym for metaphysics. Wolterstroff (1970) describes ontology from a philosophical perspective as “a description of the most general structure of what there is. It is a description of a structure so general that every other discipline will deal with some detail of the structure.” According to Gruber (2002) “ontology is a systematic account of Existence.”

a) Philosophical definition of ontology applied to financial reporting

In this study, the ontology of financial reporting proposes to interpret and generalise the most fundamental and general structure of financial reporting as documented in the CFfFR. It explores the nature of being of financial reporting in order to formally describe the general structure, the being, of financial reporting. The structure of the “financial reporting being” is obtained from the knowledge of financial reporting as officially accumulated and accepted by the accounting discipline in the CFfFR. In this study the most fundamental and general structures of financial reporting as provided in the CFfFR, were interpreted and generalised.

⁹² The following is a concise description of ontology by the Mirriam-Webster Dictionary (2014):

“Theory of being as such”. It was originally called “first philosophy” by Aristotle. In the 18th century, Christian Wolff contrasted ontology, or general metaphysics, with special metaphysical theories of souls, bodies, or God, claiming that ontology could be a deductive discipline revealing the essences of things. This view was later strongly criticized by David Hume and Immanuel Kant. Ontology was revived in the early 20th century by practitioners of phenomenology and existentialism, notably Edmund Husserl and his student Martin Heidegger. In the English-speaking world, interest in ontology was renewed in the mid-20th century by W.V.O. Quine; by the end of the century it had become a central discipline of analytic philosophy.”

Based on the definition of ontology provided by the Mirram-Webster Dictionary (2014) the ontology of financial reporting can be defined as “a particular theory about the nature of being or kinds of things that have existence in financial reporting”. Based on Smith’s (2003) description of ontology as a branch of philosophy, the ontology of financial reporting can be described as “the science of what financial reporting is, the kinds and structures of objects, properties, events, processes and relationships in every area of financial reporting”. The ontology of financial reporting is a description of the most general structure of what there is in financial reporting (Wolterstorff, 1970). The definition of Gruber (2002) adds the element of “a systematic account of” to the definition of ontology. The systematic component of the definition is provided by the formalisation of the ontology using a formal language.

The ontology of financial reporting can be described as “*a theory of the most general structure in the form of a systematic account of the nature of being, kinds of things and structures of objects, properties, events, processes and relationships in every area that have existence in financial reporting*”.

The ontology of financial reporting can be described as an interdisciplinary study between philosophy, computing and accounting with specific focus on financial reporting (Figure 6.4).

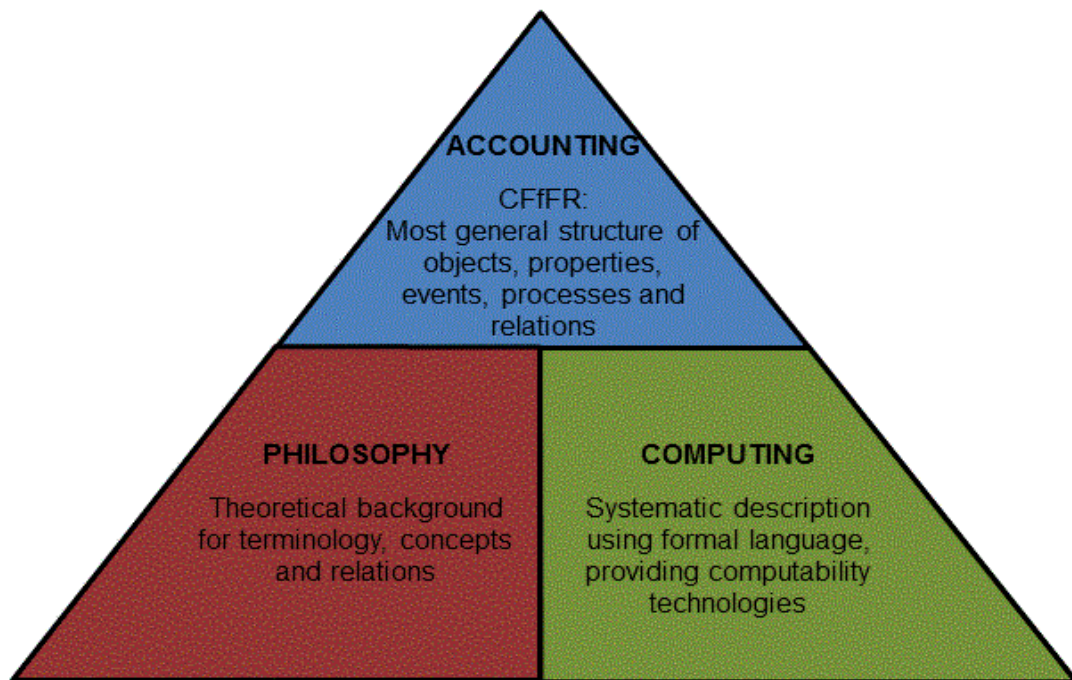


Figure 6.4: Interdisciplinary nature of the formal ontology of financial reporting

From philosophy the theoretical background regarding the use and terminologies used in the ontology are obtained. Computing provides the technologies to formalise the CFfFR in a digital format. The general structure of the objects, properties, events, processes and relationships are provided in the natural text of the CFfFR.

b) *Historical development of ontology in philosophy*

The concept of ontology originated with Aristotle, who made the distinction between physics and metaphysics (Guizzardi, 2007; Losee, 2001). Physics deals with material entities and metaphysics with immaterial entities, which are behind the physical world. Aristotle did not use the term “metaphysics”, he called the discipline “first philosophy” (Smith, 2003; Dancy, 2001) or theology and was the first to create a system of an ontology of substances. Through a cognitive process, Aristotle searched for the general properties of things that constitute their invariant form (Losee, 2001; Dancy, 2001)⁹³. These general properties are universal structures of patterns (universals) (Patterson, 2011) to be defined and axiomatized through first-order logic (Corazzon, 2013; Dancy, 2001). The quest to determine the very nature of universals occupied philosophy and the sciences since the introduction by Aristotle (Corazzon, 2013; Losee, 2001).

Although Aristotle introduced the quest for universals and the study of ontologies, the word “ontologia” was first introduced in the 17th century (Guizzardi, 2007). In some scholarly works it is stated that Rudolf Göckel (or in Latin Rudolf Goclenius) introduced the term “*ontologia*” in 1613 when he included the term in his *lexicon philosophicum quo tanquam clave philosophiae fores aperiuntur, informatum opera et studio Rodolphi Goclenii*” (Guizzardi, 2007). According to Corazzon (2013) Jacob Lorhard already used the term *ontologiae* in 1606 in the complete title of his book *Ogdoas, Scholastica continens Diagraphen Typicam artium: Grammatices (Latinae, Graecae), Logices, Rhetorices, Astronomices, thices, Physices, Metaphysices, seu Ontologiae*⁹⁴. It was Johannes Heinrich Alsted who identified ontology with metaphysics or first philosophy as general discipline of being (Corazzon, 2013).

Johann Micraelius initially made a distinction in 1653 between *metaphysica generalis* and *metaphysica specialis*. *Metaphysica generalis* presupposes the science of thinkable things (Corazzon, 2013). Formal ontology, as it is used in this study, relates to *metaphysica generalis*. *Metaphysica specialis* is concerned with special metaphysics such as psychology, pneumatology, cosmology and theology.

Christian Wolff (1679-1754), a determinist and rationalist (Hettche, 2014), and Gottfried Leibniz (1646-1716), a co-inventor of calculus, had an important influence in the history of ontology. Knowledge, according to Wolff, is obtained from the principles of logic provided by Leibniz and divided philosophy into a theoretical and practical part (Hettche, 2014). For Wolff the principle of non-contradiction and the principle of sufficient reason are valid in “all merely possible worlds in addition to the real world” (Corazzon, 2013:68.11). Although logic and ontology are two different disciplines in philosophy, Wolff connected the disciplines of ontology and logic using the principles of logic in his quest for knowledge. Logic and the principle of non-contradiction linked to ontology are important in this study in order to answer the research questions.

⁹³ See the discussion on Aristotle’s inductive-deductive method in Losee (2001).

⁹⁴ Corazzon (2013) provides a list of the texts with the term ontologia from Lorhard to Clauberg (1606-1664).

Immanuel Kant (1724–1804), historically one of the most influential philosophers, rejected Wolff's logic and his ontology as metaphysical and Platonistic (Corazzon, 2013). Although Kant introduced his own transcendental logic (Meerbote, 2001) he adopted Aristotle's logic for his system of categories to define all concepts (Sowa & Search, 2010). Kant's ontology is based on Newton's physics of natural laws (Meerbote, 2001; Förster, 2011). According to Kant, if one wants to gain knowledge, only those categories which fulfil certain spatio-temporal conditions may be used (Corazzon, 2013). It is not the world of things-in-themselves, but the spatio-temporal categorical system of relationships of the phenomena that determines the ontology (Corazzon, 2013). Kant's ontology derives from natural laws, which are supported by empirical evidence of the general structures of the physical world (Förster, 2011; Meerbote, 2001). With Kant, ontology became interdisciplinary. According to Corazzon (2013:68.13) it is "the first time in the history of philosophy and science that scientific results were thoroughly (philosophically) generalized". The ontology of sciences progressed in the twentieth century after Kant with many scientific theories with specialized cognitively languages and mathematical methods. This study links with the interdisciplinary nature of ontology as introduced by Kant (Figure 6.4).

The ontology of sciences developed after Kant in Neo-Kantianism, Positivism and Neo-Positivism, the philosophy of the Vienna Circle and in contemporary philosophy of science (Corazzon, 2013). Phenomenological ontology expanded Kant's phenomenological reduction of the world and climaxed with Edmund Husserl (1859-1938) who established the school of phenomenology (Corazzon, 2013) and broke with the positivist orientation of the science and philosophy. According to Guizzardi (2007:18) "Edmund Husserl coined the term *Formal ontology* as an analogy to Formal Logic." The aim of Formal ontology as philosophical discipline is to develop a system of general categories and their ties. Such a system can then assist "in the development of scientific theories and domain-specific common sense theories of reality" (Guizzardi, 2007:19). This study is presented as a formal ontology because it is using formal logic that forms the basis of DL, the language in which the domain-specific ontology of the CFfFR as reality is provided.

Another big influence on the study of ontology is Martin Heidegger's (1889-1976) fundamental ontology (Heidegger, 1999). Heidegger was a student and successor of Edmund Husserl at Freiburg (Corazzon, 2013). The phenomenologist Franz Brentano (1878-1917), who had a special interest in Aristotle and lectured at the University of Würzburg and the University of Vienna, influenced Husserl. Amongst Brentano's students were Edmund Husserl, Alexius Meinong, Sigmund Freud and Kazimierz Twardowski. A big influence on Husserl and Twardowski was Bernard Bolzano (1781-1848). Husserl and Twardowski rediscovered Bolzano's work on phenomenology and analytic philosophy.

Bolzano was a Bohemian mathematician, logician, philosopher, theologian and Catholic priest and one of the greatest logicians who lived between Leibniz and Frege (Edgar, 2013). He was a professor of the science of religions at the University

of Prague. In 1837, Bolzano published his *Wissenschaftslehre*⁹⁵ explaining the theory of science and the relationship between knowledge, truths and science (Edgar, 2013). In the *Wissenschaftslehre*, Bolzano is concerned with (1) the realms of language, (words and sentences), (2) the realm of thought (subjective ideas and judgements) and (3) the realm of logic (objective ideas and propositions). According to Sebestik (2014) “the main innovations of Bolzano’s logic consist in the definitions of validity, analyticity and logical truth, and the creation of a complete system of extensional relationships between propositions, the most important of these being compatibility, deducibility (= consequence), and equivalence”. This study links with the logic of Bolzano as it used formal logical to analyse and provide the relationships between the most basic concepts of financial reporting as formulated in the CFFR.

c) Influence of philosophy on computing

The philosophical concept of ontology from the tradition of Husserl, Twardowski, Meinong Hartmann and Heidegger forms the background of its adoption and use in computing, and more specifically within Artificial Intelligence (AI) (Corazzon, 2013). The third discipline therefore influencing this study via computing is philosophy. In order to identify the aspects adopted by AI from the philosophical concept of ontology, a short description of relevant aspects in the philosophical concept of ontology is provided.

According to Heidegger (1999:1) “*ontology* means doctrine of being” and “ontology” is used as a formal theory of objects and coincides with the ancient ontology or “metaphysics” (Heidegger, 1999). Heidegger emphasises that ontology is not isolated but connected to other disciplines like ontology of nature, ontology of culture, and material ontologies. Heidegger called the other disciplines the “field of being” which is to guide the treatment of problems in that ontology. In Heidegger’s phenomenology, a “*concept*” is not a schema but a possibility of being, of how matters look in the moment. It is “a meaning drawn out of something, it transports us into a fundamental experience” (Heidegger, 1999:12).

The aim of a philosophical ontology is to seek truth, to discover the natural joints separating distinct material spheres of reality of domains of objects (Zúñiga, 2001). The concern is to obtain new knowledge and to discover what exists in any domain of objects and this knowledge must not be entirely dependent on our knowledge of things in the world. In the words of Heidegger, it is to draw meaning out of something. A philosophical ontology provides an objective description of any domain of objects. The focus of computing ontologies is not primarily to obtain or discover new knowledge although computing ontologies provide tools with which new knowledge can be obtained. Computing adopted the concept of ontology to describe and understand a specific domain of objects in an unambiguous manner (Zúñiga, 2001).

⁹⁵ *Wissenschaftslehre*. Versuch einer ausführlichen und grösstentheils neuen Darstellung der Logik mit steter Rücksicht auf deren bisherige Bearbeiter, 4 volumes, Sulzbach: J. E. v. Seidel; 2nd improved edition: Leipsic: Felix Meiner, 1929, 1929, 1930, and 1931; reprints: Aalen: Scientia, 1970 and 1981; BGA I, 11–14; E of selected parts: *Theory of Science*, ed. by Rolf George, Oxford: Oxford University Press, and Berkeley-Los Angeles: University of California Press, 1972; and: *Theory of Science*, ed. by Jan Berg, Dordrecht: D. Reidel, 1973.

Computing depends on the use of formal logic to describe its ontologies in an unambiguous manner.

d) Logic and ontology

In philosophy, logic and ontology are diverse fields, but they overlap in the field of formal languages (Hofweber, 2013). Hofweber (2013) identifies four notions of logic in philosophy:

- **L1:** The first notion is the study of certain mathematical properties of artificial, formal languages concerned with first or second order predicate calculus, modal logics, the lambda calculus and categorical grammars. This logic is relevant in the philosophy of mathematics, and its application to natural languages.
- **L2:** The second notion is the logic that deals with valid inferences and good reasoning based on them. This logic is concerned with formal validity. According to Hofweber (2013:2) “to call an inference formally valid is to assume that certain words have their meaning fixed, that we are within a fixed set of representations, and that we can ignore the meaning of the other words”. The notion of logical consequence is central to this logic.
- **L3:** The third notion is the study of the logical truths or facts, and is often associated with Frege. This logic is seen as a science that describes truths or facts just as other sciences describe truths. “A logical truth is one whose truth is guaranteed as long as the meaning of the logical constants is fixed, no matter what the meanings of the other parts in a representation are” (Hofweber, 2013:3).
- **L4:** A fourth notion associated with Kant is no longer prominent but of historic importance. It is the study of most general features of thoughts or judgements. It is mostly concerned with thoughts, and not directly with linguistic representations.⁹⁶

Hofweber (2013:4) summarises the four notions of logic as follows:

- “(L1) the study of artificial formal languages
- (L2) the study of formally valid inferences and logical consequence
- (L3) the study of logical truths
- (L4) the study of the general features, or form, of judgements.”

Hofweber (2013:8) furthermore divides the discipline of ontology in philosophy into the following four parts:

- “(O1) the study of ontological commitment, i.e. what we or others are committed to,
- (O2) the study of what there is,

⁹⁶ Hofweber (2013) discusses how the different conceptions of logic are related to each other.

- (O3) the study of the most general features of what there is, and how the things there are relate to each other in the metaphysically most general ways,
- (O4) the study of meta-ontology, i.e. saying what task it is that the discipline of ontology should aim to accomplish, if any, how the questions it aims to answer should be understood, and with what methodology they can be answered.”

Based on the four notions of logic and the four parts of ontology, Hofweber (2013:8–18) provides six areas of overlap between logic and ontology, namely:

1. Formal languages and ontological commitment. (L1) meets (O1) and (O4).
2. Is logic neutral about what there is? (L2) meets (O2).
3. Formal ontology. (L1) meets (O2) and (O3).
4. Carnap’s rejection of ontology. (L1) meets (O4) and (the end of?) (O2).
5. The fundamental language. (L1) meets (O4) and (the new beginning of?) (O2).
6. The structure of thought and the structure of reality. (L4) meets (O3).

In this study, areas of overlap numbers 1 (formal languages and ontological commitment) and 3 (formal ontology) above are both valid. Regarding the overlap of formal languages and ontological commitment, the notion of logic as described in L1 is valid as the formal ontology of the CFfFR is based on a formal language DL (Description Logics). The formal language or ontolingua of the ontology in this study is computer readable (Gruber, 1992). The O1 part of ontology is applicable as the study is committed to the formalisation of the most basic postulates and principles of financial reporting. Based on the results of section 5.3.4, where the role of the CFfFR towards accounting standards was determined to be a meta-metamodel, it can be concluded that the O4 part of ontology is also applicable.

Overlap number 3 (formal ontology) is also applicable in this study. Formal ontology (L1) meets (O2) and (O3). The use and application of formal ontologies in computing is related to the characteristics that formal ontologies attempt to give precise mathematical formulations of the most general features the of concepts (properties) and the relationships of these concepts in some formal language based on a system of formal logic. It is assumed that the ideal CFfFR contains the most general concepts and relationships of these concepts of the semantic domain of financial reporting.

In this study, accounting with specific reference to financial reporting is the third discipline connected to ontology. The CFfFR serves as the field in which to search for truth regarding the role and requirements of an ideal and global CFfFR. Although notions L2 and L3 of logic, as typified by Hofweber (2013), are not included in the overlaps, they are both applicable in this study. L2 is applicable as the reasoner linked to Protégé used in this study to test the validity of inferences and the reasoning behind them. The ontology as model of the CFfFR is a truth container indicating logical truths regarding the internal coherence and logical consistency of the CFfFR, making L3 valid also. In section 5.2.3, it was established that the ontology of the CFfFR is a model containing truth.

In section 6.2.2 the value and use of formal language and ontology and the areas of application to this study is indicated.

6.2.2 Formal Language and Ontology

“Logic” and “ontology” are important areas in philosophy, and different philosophers have used them in different ways (Hofweber, 2013). The basis for formal principles of reasoning and correct inference is situated in the science of logic (Simpson, 2000). In order to build a formal ontology within computing, a formal language (or computational logic) with well-defined semantics and powerful reasoning tools are required (Gerber & Gerber, 2011).

According to Hofweber (2009), formal tools like artificial languages, formal logic expressed in such languages and mathematical proves were developed in philosophy under the heading philosophy of mathematics over 100 years ago. In terms of the value of the use of formal tools Hofweber (2009) has indicated that the use of formal tools such as formal languages are limited in that they can be a source of error. According to Wang and Schagrin (2014:1) “a formal language usually requires a set of formation rules - i.e., a complete specification of the kinds of expressions that shall count as well-formed formulas (sentences or meaningful expressions), applicable mechanically, in the sense that a machine could check whether a candidate satisfies the requirements”. The complete specification contains three parts: (1) a list of primitive symbols, (2) combinations of these symbols, and (3) a set of inductive clauses (Wang & Schagrin, 2014). Several different logical formalisms were developed through the ages, of which First-Order Logic (FOL) is noteworthy.

The limitations of logic are also indicated by Hintikka (2014). However, the value in the use of a formal language is that formal tools “are at best used to represent results established by other means” (Hofweber, 2009:217). This study profits from the value in the use of formal tools as it uses a formal language to represent the CFfFR, established by the IASB, using recognised ontology technologies.

In Figure 6.5 provided by Guarino et al. (2009), languages are sorted into informal natural languages such as textual terms and definitions to formal approaches such as first-order, higher-order, modal logic.

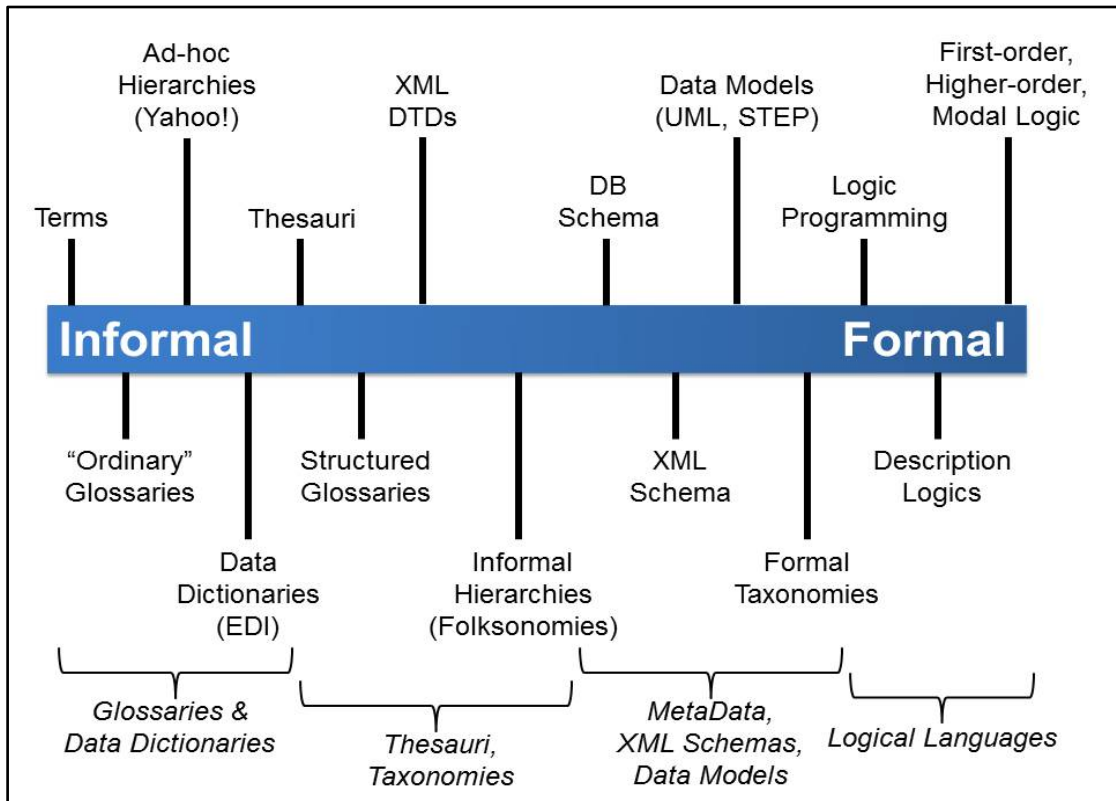


Figure 6.5: Types of languages, sorted from informal to formal

The languages on the informal side of the figure are less exact and have a higher potential for ambiguous meanings. The languages on the formal side of the figure are more exact as they are based on formal logic, thus reducing the possibility for ambiguous meanings. Formal approaches or logical languages allow specifying rigorously formalised logical theories (Guarino et al., 2009). The use of a formal (logical) language contributes to the rigor and exactness in the communication process. Another benefit of using a formal language is that a computer can read and “understand” the formal language. With the help of formal tools available in computing, a computer can make logical inferences based on the formal language. The reasoner (a computer program) tests the logical consistency of what is communicated in the formal language – i.e. the formal ontology of the CFfFR.

The summary provided by Guarino et al. (2009) and Uschold and Gruninger (2004) puts Description Logics (DL)⁹⁷ used in this study, in perspective. Description Logics is a decidable fragment of Formal Ontology Languages (FOL) (Nardi & Brachman, 2007) as the logic to formalise the CFfFR by building a formal ontology of the CFfFR. Calvanese and De Giacomo (2003:185) provides the following characteristics of expressive description logics:

⁹⁷ See an extensive discussion on DL in Baader, Calvanese, McGuinness, Nardi, and Patel-Schneider (2007) and in Calvanese and Giacomo (2003).

“(i) The language used for building concepts and roles comprises all classical concept forming constructs, plus several role forming constructs such as inverse roles, and reflexive-transitive closure.

(ii) No restriction is posed on the axioms in the TBox.”

Apart from the benefit of testing the logical consistency of the formal ontology of the CFfFR, the importance of logical consistency is argued to be a pre-requisite for cross-cultural acceptance of theories.

6.2.3 Logical Consistency as Pre-requisite for Cross-cultural Acceptance of Theories

One of the problems with harmonisation and the global acceptance of the CFfFR and financial standards is the barrier of cultural differences. An example of such a cultural barrier is the publication of the Stamp Report by CICA after the release of the FASB conceptual framework (Stamp, 1980). It contains contradicting opinions due to the effect of cultural differences on financial reporting.

Social, cultural and political differences as stumbling blocks are confirmed by Hussein (1996:95) when he states that “the original idea of harmonization as moving towards uniformity in accounting standards across countries may not be achieved as long as social, cultural, and political differences exist across countries”. According to Hofstede (1985) there is limited convergence between cultures and cultural differences are substantial and require the attention of those dealing with cross cultural activities.

On the contrary, there are claims that culture does not have an influence on financial reporting from common law countries. Jaggi and Low (2000) examined the impact of legal systems on financial disclosures by firms from different countries. Jaggi and Low (2000) noticed that firms from common law countries have a higher degree of commonality in financial disclosures than firms from code law countries. The cultural impact on financial disclosure by firms from common law countries was insignificant and the results by firms from code law countries were mixed.

Hussein (1996) proposed a reconciliation strategy where an agreement is reached on basic recognition and measurement criteria and on a framework that enables users to reconcile financial statements from different countries while it also satisfies those countries’ regulatory requirements as a solution for cultural differences. The solution proposed by Hussein (1996) seems practical, but it still does not bring us closer to a global CFfFR. In this study, logic is proposed as part of the solution to draft a global CFfFR. From the field of semantics and translation, the principle is accepted that words do not have meanings, meanings have words and all meanings can be clearly expressed in all languages (Louw et al., 1989; Nida, 1981; Nida & Taber, 2003; Nida, 1969; Nida, 1991). What should be made clear in translation is not the words or even the structure of the words, but the intended meanings of the words within the context the specific words are used in. The implication of this principle is that exact meanings can be clearly communicated across different cultures if the intended meanings are translated into the cultural context of the target language.

Antonites (2006) noted that certain values and theories in science are accepted across cultures and over historical periods. Even thinkers from postmodern and modernistic paradigms argue with each other and agree on contradictions. It assumes something universal. According to Antonites (2006) Aristotle, Newton, Einstein, Max Weber, Gadamer and Habermas use the same logic. Nobody, regardless of their cultural orientation, accepts inherently contradictory statements. The value of logic is that it transcends cultures and takes time to form an underlying coherence and common ground shared between the participants in a discussion (Antonites, 2006).

The value of logic to the global acceptance of the CFfFR is emphasised by Malinvaud (1995:211) when he states the importance of a conceptual framework for accounting to build a macro-economic theory as follows: “A system of rigorously defined concepts and measures is required for any body of scientific knowledge”. “Rigor”, implies that the definitions in the conceptual framework should be able to withstand the onslaughts of logical testing to provide reliable micro data sets. At the end, it is not only the accountants and investors all over the world that would benefit from a global CFfFR, but also the economists.

We are in the fortunate position to witness the value and power of logic in successful and cross-cultural acceptance of multi-national and multi-disciplinary projects such as SNOMED CT and the Gene ontology (Smith, 1989; Smith, 2003). This study takes advantage of the value of logic by using Description Logics (DL), a language based on logic, to build a formal domain ontology of the CFfFR. In this study formal logic, the underlying basis of DL, is presented as the bridge to cross the cultural barrier to a global CFfFR.

Based on this background of ontology in philosophy the transformation from ontology in philosophy to ontologies in computing is provided.

6.3 Ontologies: Computing and Financial Reporting

In Chapter 2, the historical development of the CFfFR was described using a stimulus/response system, indicating that the development of the CFfFR is the result of a reaction to various external stimuli. The development of ontology technologies in computing can be another external stimulus to the development of the CFfFR.

The literature on computing presents a couple of definitions for ontologies. As the concept “ontology” originated in philosophy (see section 6.2), the meaning of ontology in computing is linked to the philosophical meaning of ontology but with a specific application in computing. The definition evolved with the development and application of formal ontology technologies. In section 6.3.1, a short background on the development and use of ontologies in computing is provided to argue the applicability of ontologies for this study.

In section 6.3.2, the link between ontologies conceptual modeling, models and metamodels are provided. In section 6.3.3, the interdisciplinary relationship between accounting, philosophy and computing is concluded by motivating the benefits of building a formal domain ontology of the CFfFR.

6.3.1 Background on Ontologies in Computing

Computing only recently adopted the concept of *ontology* from philosophy (Palmer 2001). Guan et al. (2013:21) summarises the differences between ontology in philosophy and computing as follows:

“The targets for philosophical ontology are the things themselves and the relationships existing among them. ontology research in the CS/IS context is concerned with the study of a specific domain to tackle more practical issues but CS/IS ontology research employs a similar approach (as that in philosophical ontology research) and relies on theories from philosophical ontology.”

This study is mainly concerned with ontologies as it is applied in computing but it also employs theories from philosophical ontology, therefore the discussion on ontology in philosophy in section 6.2.

Before the meaning and use of ontology in computing is discussed, the term “ontology” as it is defined in computing is investigated. The term *ontology* is currently popular and used to refer to anything from taxonomy, a domain vocabulary and a conceptual model to a formal logic-based ontology (McGuinness 2003).

Figure 6.6 and Figure 6.7 are examples of the Gene Ontology (GO) as published by the Gene Ontology Consortium. These figures illustrate the how very complex domains can be formalised using ontology technologies.⁹⁸

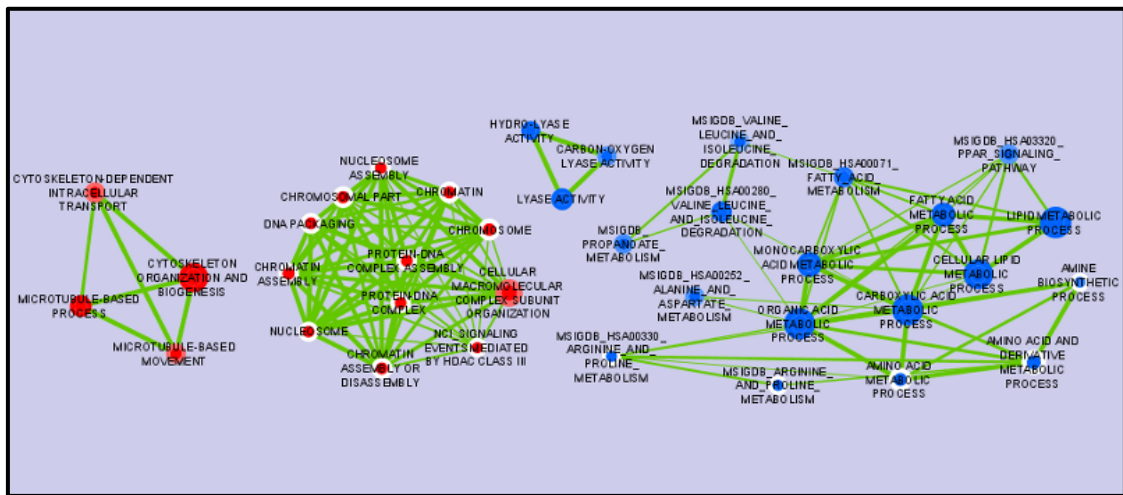


Figure 6.6: Gene Ontology CytoScape EM (Source: (Gene Ontology Consortium, 2015))

⁹⁸ The purpose of these figures is not to explain the Gene Ontology it only serves as examples on how a very complex domain can be formalised.

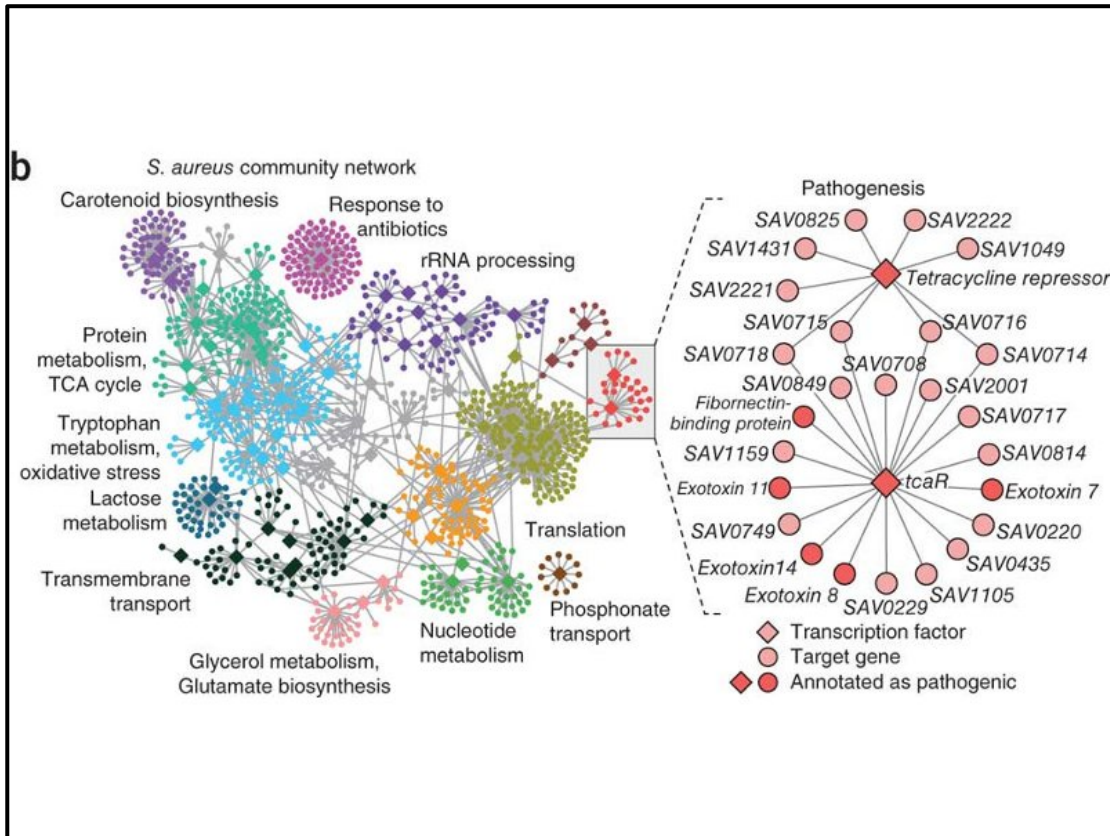


Figure 6.7: Gene Ontology *S Aureus* Term Enrichment (Source: (Gene Ontology Consortium, 2015))

Within computing, an ontology is defined as a shared, formal, explicit specification of a domain, typically describing a hierarchy of concepts and associating each concept's crucial properties with it (Broekstra, Klein, Decker, Fensel, Harmelen, et al., 2001). Gruber (1995) borrowed his definition from philosophy, and states that "an ontology is a systematic account of Existence" and he then defines ontology as "an explicit specification of a conceptualisation". "Conceptualization" as used by Gruber, is according to Zúñiga (2001) the objects, concepts and other entities that are assumed to exist in some area of interest and the relationships that hold among them. A conceptualisation is seen as an abstract, simplified view of the area of interest that is to be represented. The CFFR can be viewed as an abstract, simplified view of financial reporting. This study provides an explicit specification of the CFFR. The "explicitness" in this study was obtained by using a formal language.

a) Formal and unambiguous representation of primitive terms

Gruber links ontologies in information systems (a sub domain of computing) with philosophical formal ontologies⁹⁹ by stating: "...knowledge of a domain is represented in a declarative formalism." According to Mineau (1993:90) as stated on the first International Conference on Conceptual Structures, "an ontology of domain can be

⁹⁹ See the discussion in Hofweber (2013) regarding representational Formal ontologies.

described as the set of the basic elements pertaining to the description of the domain. These basic elements are called *primitive terms* of the domain, and from them, any other object in the domain can be described". From the discussion on the history of the CFfFR (see Chapter 2), it is clear that the CFfFR is the historical result of the most basic postulates and principles accepted by a large part of the accounting community of financial reporting. It can be expected that the CFfFR should provide the *primitive terms* of financial reporting.

In Artificial Intelligence (AI) systems within computing, what "exists" is that which can be represented (Gruber, 1993; Gruber, 1995). Computational ontologies formally model the structure of a system (Guarino et al., 2009).

From the discussion above, it can be argued that the purpose of ontologies in computing is to *represent* what exists (a specified system or domain). The computing purpose of ontologies differs from the aim of ontologies in philosophy, which is to seek or discover the truth. An ontology in computing can therefore be a *representational vocabulary* that is used to describe the relationships between the set of objects of a domain to represent the knowledge of a specified domain without claiming to discover the truth or to obtain new knowledge.

The representational vocabulary must be based on logical principles to be able to model relationships between concepts in an inherent logically consistent manner. At the same time, the vocabulary must also be computer readable to build a computational artefact of the relationships between the set of objects of the specified system or domain. In order for the vocabulary to be computer readable, an ontology must be semantically perfect with no ambiguous terms or notions (Flahive, Taniar, Rahayu, & Apduhan, 2009). The requirement that an ontology must be semantically perfect and unambiguous corresponds with the requirement of logical consistency for the ideal CFfFR identified in Chapter 5.

b) Computational formal logic and ontologies

In essence, an ontology in computing is a special kind of information object or computational artefact that captures the knowledge of a specified system or domain in a computer readable form. Furthermore, if it is a formal ontology because the model is constructed using a computation formal logic, it means that a computer can not only read the ontology but also reason with the knowledge and draw logical inferences from the assertions¹⁰⁰.

In order to formally model or capture the knowledge of a specified system, the relevant entities and relationships of a system or domain the ontology engineer analyses and organises the different entities of a system into its most basic concepts (also known in philosophy as universals or primitives) and relationships between

¹⁰⁰ If we assert that a) *all birds can fly*, b) *all parrots are birds*, and c) *Polly is a parrot*, an example of a logical inference for the a, b and c assertions would be that *Polly can fly*.

those concepts (Guarino et al., 2009).¹⁰¹ A taxonomy of the basic concepts of a system or domain forms the backbone of an ontology (Guarino et al., 2009). The basic concepts are organised according to a hierarchy of the relationships between them.

An example from the financial reporting domain is to identify the concepts *resource*, *fixed asset* and *buildings*. Resource is a super-concept of fixed asset and building. A physical building owned by an entity (business) would be an *instance* of its corresponding concept building. The relationship between the different concepts should then be determined and the concepts then connected according to the relationships. The reasoner is then able to test the logical consequences and inferences of the concepts and their relationships. In this study, only the concepts and their relationships as they are portrayed in the CFfFR are formalised.

Simon et al. (2006:224) confirmed the hypothesis that the “methodology and conceptual rigor of a philosophically inspired formal ontology brings significant benefits in the development and maintenance of application ontologies”. This study intends to explore the significant benefits by developing a philosophically inspired formal domain ontology of the CFfFR. In a pilot study building a small ontology of the elements of the statement of financial position as defined in the CFfFR, Gerber et al. (2014) demonstrated the applicability and documented some results of the formalisation of the definitions for asset, liability and equity.

6.3.2 Ontologies, Models and Metamodels

In section 5.2, it was argued that an ideal CFfFR could serve as a truth bearing model helping to construct a global CFfFR. In section 5.3, it was indicated that the CFfFR can be typified as a type model and that the CFfFR serves as a metamodel towards accounting standards and as a meta-metamodel towards financial statements. In sections 6.2 and 6.3.1 the applicability of ontology in philosophy and ontologies in computing to the CFfFR were argued. In section 6.3.2, the relationships between ontologies in computing, models and metamodels are indicated in order to justify the building of a formal domain ontology of the CFfFR in its role as a metamodel and meta-metamodel. It is argued in section 6.3.2 that conceptual modeling, as used in computing, provides the link between the ideal CFfFR as meta-metamodel truth bearer, indicated in Chapter 5, and the building of a formal ontology of the CFfFR.

¹⁰¹ Alternative terms for “concept” are “property” or the philosophical term “universal” which, in philosophy, are those entities that can have instances. The term “property” are not be used in this study, as “property” can be confused with the accounting concept “property”, which forms part of fixed assets. As it seems that computing standardised on the use of the term “concept”, the term “concept” is used in this study.

a) Conceptual modeling and the CFfFR

Conceptual modeling is a well-researched and documented concept in computing and started as a discipline in computer science in the 1970’s (Wieringa, 2011).¹⁰² According to Wilmont et al. (2013:74) “Conceptual modeling is a core activity in systems analysis, involving reasoning with concepts and the relationships between them”. Conceptual modeling is used as a communication framework between developers and users and it helps analysts to understand a domain (Wilmont et al., 2013). According to Henderson-Sellers (2011a:104) it is accepted “that both models and metamodels (and indeed metamodels) in Computing can be regarded as conceptual models”.

The following definition of a model provided by Wilmont et al. (2013:75) contains all the elements of the model theory used in this study: “A model is an abstract unambiguous representation of a domain of interest, comprising concepts and relationships, which illustrates the behaviour and structure of a real-world system”. In Table 6.1 an application of the definition provided by Wilmont et al. (2013) to this study is provided.

Table 6.1: Wilmont et al. (2013) model definition applied to financial reporting domain

Definition	Application
A model is	The formal ontology of the ideal CFfFR and the CFfFR are models and metamodels (see Chapter 5).
an abstract (representation)	The CFfFR and the formal ontology of the CFfFR are abstract representations of the financial reporting domain.
unambiguous representation	Although the CFfFR is not unambiguous, the formal ontology is unambiguous due to the use of OWL DL, the semantic reasoner and Protégé.
of a domain of interest	The domain of interest is financial reporting as conceptualised in the CFfFR.
comprising concepts and relationships	The most basic concepts and relationships as formulated in the CFfFR are identified and modelled in the ontology
which illustrates the behaviour and structure of	The CFfFR provides the behaviour and structure of the financial reporting domain as formulated by the IASB. The behaviour and structure of the CFfFR are illustrated when analysed with the reasoner and presented in graphic format with the tools available in Protégé.
a real-world system	The real world system for the CFfFR is the financial reporting domain. The CFfFR is an abstraction of the real world system providing the basic postulates and principles of the financial reporting domain. The formal representation of the CFfFR is an abstraction of the CFfFR, which serves as the real world system for the formal ontology.

¹⁰² The following are some publications on conceptual modeling and ontologies (Borgida & Brachman, 2003; Guizzardi, Herre, & Wagner, 2003; Wand, Storey, & Weber, 1999; Wieringa, 2011; Sugumaran & Storey, 2002; Henderson-Sellers, 2011a; Guizzardi, 2006; Henderson-Sellers, 2011b; Wilmont et al., 2013).

From the application of the CFfFR and the formal ontology of the CFfFR to the definition of a model above provided by Wilmont et al. (2013), it can be argued that the CFfFR as model complies, with the exception of unambiguity, with the definition of a model provided by Wilmont et al. (2013). The formal ontology of the CFfFR complies with all the aspects of the definition of a model as it is used in computing.

b) The CFfFR as a digital domain

In order to understand the social impact of the formal ontology of the CFfFR as a proposed automated solution for the real world problem domain, Wieringa (2011) provides a distinction between three kinds of domains namely, physical domains, social domains, and digital domains. A physical domain is described in terms of time, space, energy and mass and borrows terms from the physical sciences (Wieringa, 2011).

The second domain is called a social domain. Wieringa (2011:13) describes a social domain as follows:

“A *social domain* consists of social constructs such as money, commercial transactions, value, business processes, goals, job roles, responsibility, accountability, etc. The characteristic feature of a social domain is that it contains people who have a shared conceptual model of this domain. Many domain entities and events, such as organizations, job roles and money, are social constructions that would not exist if there were no people who share a conceptual model of these entities and events.”

Examples of social domain entities in the accounting and finance environment would be an organisation such as the IASB, an auditing firm, the SEC, the New York Stock Exchange, a reporting entity or even the accounts department of a reporting entity. The positions of the CEO or CFO of reporting entities are domain entities and the activities of the CEO or CFO can be described as domain events. The CFfFR or the annual financial statements of a reporting entity do not adhere to Wieringa’s (2011) definition of a social domain.

Digital domains form the interface between physical and social domains (Wieringa, 2011) and consist of symbols and their physical occurrences. The physical occurrences of digital domains are things like paper, ink, signals traveling through a wire and magnetic disc spaces. The digital symbols have meanings for people, defined by a convention chosen by a group of people (Wieringa, 2011). The meanings are recorded in various physical occurrences and symbols like natural language dictionaries, program languages and documents like legal acts, constitutions and conceptual frameworks. According to Wieringa (2011:14) “the relationship between a physical symbol occurrence and its meaning is a social convention that from a physical point of view is arbitrary and could have been defined differently”.

Based on the definition of a computer model by Wieringa (2011), the CFfFR and financial reporting domains can be viewed as digital domains. A meaning of the

financial reporting domain is recorded on paper or in a digital document of the CFfFR. The CFfFR as metamodel or meta-metamodel is a physical occurrence of the financial reporting domain. The relationship between the CFfFR as physical symbol occurrence and its meaning is a social convention that is arbitrary and could have been defined differently by another community. In this study, the digital domain was implemented in a software system to eliminate arbitrary interpretations of the physical occurrence.

The effect of inserting the software system to the financial reporting domain has created an effect domain (Wieringa, 2011) – another domain model of the CFfFR. The effect domain model created new possibilities for action such as answering some questions on internal coherence and logical consistency of the physical occurrence – the CFfFR. The conceptual modeling activity applied in this study has created a truth bearing model providing some information on the real-world digital domain (*R*) (see section 5.2.4) (Mäki, 2011). The formal model created in this study can be typified as a digital domain model of another digital domain model, the CFfFR, in its physical occurrence.

Based on the discussion above, it can be concluded that conceptual modeling in computing is applicable for this study. In order to achieve the effect of the new domain model and create the new possibilities of actions mentioned above the new domain model was formalised using ontology technologies.

c) *Ontologies, models and metamodels*

Ontologies as used in computing are a particular kind of model. Ontologies developed in artificial intelligence thinking while metamodeling and conceptual modeling were investigated in software engineering (Henderson-Sellers, 2011b). Guarino (1998) distinguishes between four different kinds of ontologies in computing according to their level of generality, or point of view. The four ontologies are top-level ontologies, domain ontologies, task ontologies and application ontologies.

Top-level ontologies, also known as upper ontologies (Mascardi, Cordì, & Rosso, 2007) are independent of a particular problem or domain. Upper ontologies “describe very general concepts like space, time, matter, object, event, action etc.” (Guarino, 1998:9) across all domains. Upper ontologies are used to integrate heterogeneous knowledge from different sources (Mascardi et al., 2007). Upper ontologies provide languages for the most basic concepts and relationships that are not domain specific.¹⁰³ In this study, the basic concepts and relationships as specified in DOLCE were used as basis to integrate knowledge from accounting, computing and philosophy the three different disciplines in the study.

Domain ontologies are domain specific and provide a formalised vocabulary related to a specified domain. Domain ontologies utilise the terms (concepts and relationships) introduced in an upper ontology. A domain ontology serves as a

¹⁰³ See the discussion by Mascardi et al (2007) for a comparison of different upper ontologies.

knowledge base for a specific domain. Task ontologies describe a specific task and provide a formalised vocabulary related to a specific task.

According to Guarino (1998) concepts that depend on both a particular domain and a task can be described as an application ontology. The concepts correspond to roles they play in a domain while performing a certain activity. A replaceable unit or spare components are examples.

It was already argued that the CFfFR could be described as a digital domain metamodel. The specified domain within which the CFfFR functions is the domain of financial reporting with the purpose to provide guidelines for the development of accounting standards that are principally based, internally consistent and internationally converged.

d) Formal languages and computability of formal ontologies

Ontologies has a strong resemblance to conceptual models and metamodels (Guizzardi, 2005), with the difference that ontologies need an ontology representation language. Ontology representation languages are based on formal logic. First-order-logic languages provide the widest expressivity but are not computable. In order to utilise the benefits of formal logic, the Web Ontology Languages (OWL) were developed (McGuinness & Van Harmelen, 2004). The Semantic Web vision by the Web ontology Working Group required an ontology language that can formally describe the meaning of terminology used in Web documents. The language had to be able to perform useful reasoning tasks on web documents (McGuinness & Van Harmelen, 2004).

One of the sublanguages of OWL is OWL DL. McGuinness et al. (2004:6) describes the use and characteristics of OWL DL as follows:

“OWL DL supports those users who want the maximum expressiveness while retaining computational completeness (all conclusions are guaranteed to be computable) and decidability (all computations will finish in finite time). OWL DL includes all OWL language constructs, but they can be used only under certain restrictions (for example, while a class may be a subclass of many classes, a class cannot be an instance of another class). OWL DL is so named due to its correspondence with description logics, a field of research that has studied the logics that form the formal foundation of OWL.”

This expressiveness, computational completeness and decidability of OWL DL were utilised when the formal ontological representation of the CFfFR was created. In this study, OWL DL was used with the semantic editor Protégé and the semantic reasoner FaCT++.

Protégé is an open source ontology editor and knowledge acquisition system. It includes deductive classifiers to validate if models are consistent. This feature is used to test the inherent consistency of the CFfFR when it is rewritten as a formal representative domain ontology. FaCT++, a semantic reasoner, is software able to infer logical consequences from a set of asserted fact or axioms. The ontology

language OWL DL specifies the inference rules used by FaCT++. The logical consequences of the formal domain ontology of the CFfFR were tested using the semantic reasoner.

Ontologies are conceptual models with the additional characteristic that they are presented in a formal language based on formal logics. The benefits of using a formal language such as OWL DL are that the formal language adds enhanced expressiveness, computational capabilities and decidability to the model. Combined with a semantic reasoner and a semantic editor the logical consequences and inferences of the ontology can be tested by the software.

The intended purpose of ontologies, just as with models, determines if a specific ontology functions on the model, metamodel or meta-metamodel level. An upper ontology such as DOLCE functions on the metamodel and meta-metamodel level. The function of an ontology within a specific domain determines the model function of the domain within that specific domain.

Based on the discussion above, the third research question was answered by building a formal representative domain ontology of the CFfFR. The application of formal domain ontologies on accounting is explained in section 6.3.3.

6.4 Formal Domain Ontologies and Financial Reporting

The nature and characteristics of formal domain ontologies as utilised in computing have potential to assist in building a global CFfFR. The third and main research questions¹⁰⁴ were answered by building a formal domain ontology. The formal domain ontology of the CFfFR indicated some unintended meanings and logical inconsistencies in the CFfFR. The formal domain ontology of the CFfFR provides some indicators on how to comply with the role, requirements and definition of an ideal CFfFR that could be globally acceptable.

The building of the formal domain ontology of the CFfFR was the last activity (fourth DSR Cycle) in the process to determine and test the requirements of a global CFfFR. The purpose of the formal domain ontology of the CFfFR was an attempt to get closer to the ideal CFfFR according to the ideal assumptions developed in Chapters 4 and 5.

The first activity (DSR Cycle 1) in Chapter 4 was to determine the definition and requirements of the CFfFR. Idealised assumptions were derived in Chapter 4 from existing publications on the CFfFR, using a systematic review. The Chapter 4 idealised assumptions and requirements were further refined in Chapter 5 (DSR Cycle 2) using model theories to define the role of an ideal CFfFR. From philosophy,

¹⁰⁴ The **main research question (MRQ)** is: How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

Sub-research Question 3 (SRQ 3) is: How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

it was determined that the formal domain ontology of the CFfFR, based on idealised assumptions, is a model bearing truth of the reality (R), i.e. the CFfFR. From the theory on models in computing it was determined that the CFfFR functions, according to the OMG four level hierarchy of models, as a type model on a meta-metamodel level (M3).

In order to exploit the benefits of viewing the role of the CFfFR as a meta-metamodel within the financial reporting domain, the possible contributions of ontology in philosophy and ontologies in computing were investigated in Chapter 6 (DSR Cycle 3). According to the study of ontology in philosophy, it was determined that the ideal role of CFfFR is that it should function as an upper formal ontology for the financial reporting domain. The benefits of an ontology are that it provides the most basic concepts and relationships with another discipline to guide the treatment of problems in that domain. In this study, the “field of being”, as the other discipline is called by Heidegger (Heidegger, 1999), is the field of financial reporting. Ontology as understood in philosophy, also contributed the use of a formal language based on formal logic. The use of a formal language in an ontology assists to obtain logical consistency in the specific ontology. Logical consistency is viewed as one aspect that contributes to global acceptance of a theory (see section 6.2.3).

In this study, the benefits of the computability and expressivity of OWL DL as a formal language were used to build a computer readable and logically consistent ontology of the CFfFR. Formal domain ontologies are used in computing to build ontologies of specific domains in order to understand and conceptualise the concepts and relationships of a specific domain in a logically consistent manner. The CFfFR can be viewed as a representation of the most basic postulates and principles of the financial reporting domain, accepted by a large portion of the accounting community. When the CFfFR and the formal domain ontology of the CFfFR are viewed as models, the role function of these models can be explained from the perspective of conceptual modeling in computing.

6.4.1 Related Work on Ontologies in Financial Reporting

An investigation of the literature indicated that formal ontologies as used in computing have not readily been applied to the CFfFR. A summary of related and prominent publications is provided below. The summary does not provide a complete list of all the publications on ontology/ies and accounting. The selection of the publications indicated below was based on its relevance to this study.

According to De Pree (1989:61) a rigorous procedure to evaluate a theory consists of “two conceptually distinguishable but interrelated parts”. The evaluation procedure was applied to the conceptual framework of the FASB. The sentences constituting the logical structure of the theory and its inferences in the FASB conceptual framework were tested by way of using mathematical or logical proves as well as “by way of evidence, be it empirical, intuitive, or otherwise” (De Pree, 1989:61). The study by De Pree (1989) tested the logical structure of the FASB conceptual framework and demonstrated that the structure of the FASB conceptual framework is indeed logically consistent. This study tested the natural language of the CFfFR for

internal logical coherence by analysing the natural language sentences into its most basic concepts and relationships contained within the sentences.

Carlson and Lamb (1981) applied an axiomatic formulation in predicate logic on certain fundamental portions of accounting theory. Carlson and Lamb (1981) constructed the basic vocabulary of accounting from a base of primitive terms, introducing a set of axioms and rules of inference, and deriving theorems stating certain characteristics of financial positions and income within the system. The publication concludes with the following five beneficial qualities of the axiomatic method for accounting research (Carlson & Lamb, 1981:569):

1. "It exhibits with precision the logical connections of the discipline.
2. It has a great unifying power capable of relating the various terms and concepts of a field to all of the other terms and concepts.
3. Such an analysis may reveal unsuspected consequences in our existing assumptions, leading to discoveries or at least to suggestions for profitable research.
4. An axiomatic system provides a context, or manner of conceptualizing a problem that, if adopted by all participants in a discussion, will greatly facilitate communication between them.
5. The system may indicate the fruitlessness of certain controversies which arise largely because of meta-physical or linguistic confusion."

The formal domain ontology of the CFfFR benefits from the five qualities stated above.

Partridge (2002a; 2002b) discussed some ontological choices necessary for the development of a conceptual framework from a philosophical perspective. Partridge (2002b:1) argues for a "shift in the foundations and framework of accounting's conceptual scheme". The proposal is that the new foundation should be a reference ontology. This study is in agreement with this discussion and the necessity to argue the philosophical grounding of fundamental choices of accounting concepts as a topic of further research.

Aparaschivei (2007) emphasises the importance and value of creating an accounting ontology from a theoretical perspective. According to Aparaschivei (2007) an accounting ontology building consists of two knowledge categories. The first category involves factual domain knowledge about objects, relationships, events, states and causal relationships. The second category involves problem-solving techniques on how to achieve certain purposes. This study utilises both knowledge categories. The formal domain ontology of the CFfFR consists of the knowledge categories and is aimed at solving the problem to draft a global CFfFR.

Teller (2008) introduced a model to represent accounting standards and financial information. Teller (2008) proposed the notion of syntactic and semantic modeling. Although Teller (2008) also used Protégé to build the ontology, it differs from this

study in that this study is concerned with the building of a formal domain ontology of the CFfFR. Teller (2008) illustrated the value of ontology technologies by applying it to case studies.

Chou et al. (2008) presents an ontological approach proposing knowledge management via ontology development in accounting. ontology is used to “explain the profit and loss account as a representation of the potential use of this methodology” (Chou et al., 2008:36). According to Chou et al. (2008:36) the benefit of the proposed ontology is that it “expands the researcher’s ability to generate information by using search methods beyond simple keywords”. The benefit of having a formal ontology of the CFfFR that is readable by a computer is that it creates possibilities for researchers that are not possible on a text written in natural language.

Dahab et al. (2008) use TextOntoEx to extract candidate relationships and then maps them into meaning representation to facilitate the constructing of an ontology. The work by Dahab et al. (2008) supports the construction of domain relationships and non-taxonomic conceptual relationships and applies it into a case study of the agricultural domain. This study takes advantage of constructing domain relationships as it is presented in the natural text of the CFfFR.

Chou and Chi (2010) proposes an ontological Event, Principle and Account (EPA) model to describe accounting principles. An OWL-based ontology was used to demonstrate some EPA examples. According to Chou and Chi (2010), in order to build a domain-specific ontology the existing domain ontology must be examined. In accounting, knowledge regarding the domain is in accounting standards, textbooks and literatures coded in natural text. Chou and Chi (2010:2318) opted to utilise the “*reconstructed method*” “to reconstruct accounting knowledge and transform it into ontological artefacts”. Chou and Chi (2010) reconstructed the class hierarchy of merchandise inventory with reference to accounting standards.

The study by Chou and Chi (2010) differs from this study in that this study built a formal ontology of the CFfFR using the natural text as basis to identify the most basic concepts and relationships on a conceptual basis. The work of Chou and Chi (2010) proposes to link actual transactions (Event) with a reconstructed principle (Principle) and general ledger accounts (Account). The purpose of the study by Chou and Chi (2010) is to demonstrate the possibility of an ontology that could capture and classify a cash sale transaction. According to Chou and Chi (2010:2322) the second contribution of their study is that “the ontological *Principle* construct can be further applied to validate the quality of existing accounting standards, for example to test for inconsistency between those standards, and basic accounting concepts”.

The formal domain ontology of the CFfFR is the first step towards the second contribution formulated by Chou and Chi (2010) as it provides the basic accounting concepts in an inherently consistent manner. Similar formal ontologies of accounting standards can then be tested for consistency against the formal ontology of the CFfFR. The formal ontology of the CFfFR is also a step towards the third contribution proposed by Chou and Chi (2010). The formal ontology of the CFfFR is the first step towards creating an expert system containing full accounting knowledge, with the

difference that it is based on the actual text accepted by the IASB. One of the benefits of the formal ontology of the CFfFR is that it can act as an intelligent facilitator to assist in setting accounting standards.

An ontology representation of business reporting data and metadata structures as defined in the eXtensible business reporting language (XBRL) standard is provided by Spies (2010). Spies (2010) applies the OMG four level hierarchy model on the XBRL reporting structures. This differs from this study that applies the OMG four level hierarchy on the financial reporting domain (section 6.3.3 and Figure 6.6). According to Spies (2010) (M0) is an instance level and comprises the actual object of the domain e.g. an XBRL reporting document. “*The instance level (M1) comprises the XBRL analytic taxonomies and calculation rules relevant for a reporting instance document e.g. a balance sheet item*” (Spies, 2010:407). On modeling language level (M2) Spies (2010) positions the principles of defining analytic taxonomies and also refers to it as the metamodel level. On modeling language definition level (M3) Spies (2010:407) positions “the basic object modeling language or modeling elements in terms of which the M2 level language (the metamodel) can be built”. Spies (2010) also refers to this level as the meta-metamodel level. This study differs from Spies (2010) in that it does not focus on the taxonomy XBRL level but on the actual natural text of the CFfFR at a metamodel level.

Krahel (2012) submitted a Ph.D. dissertation to the Graduate School of Newark with the title “On the formalization of Accounting Standards”. The study provides an ontology serving as a framework for analysis of lease accounting standards published by the FASB. Krahel (2012) did not create a computable ontology based on a formal language. The study is limited to the illustration of lease transactions.

Litherland et al. (2013) explored how an ontology or conceptual map of introductory financial accounting can be used to provide value and reliable marking of free-text answers on an ontology-based e-assessment system. Although this study uses ontology technologies it is not concerned with the formalisation of the CFfFR.

Wu (2013) submitted a study in partial fulfilment of the requirements of a Master of Science (M.Sc.) in Computational Logic. The study by Wu (2013) is aimed at the characterisation of concepts in the XBRL taxonomies in order to address the diversity in the XBRL taxonomy comparability problem. The study attempts to solve the taxonomy alignment problem by transforming it into an ontology-matching problem.

Mattessich (2013) published a book with the title “Reality and Accounting: Ontological Explorations in the Economic and Social Sciences”. The publication is concerned with general ontological questions. The publication does not propose to be an accounting ontology or a domain ontology of accounting, but discusses ontological questions from accounting theory. The publication differs from this study in that it does not create an ontology of the CFfFR but rather discusses ontological concepts from a theoretical perspective.

Based on the discussion above of related work, it can be concluded that at the time that this study was conducted there were no other studies relating to the formalisation

of the CFfFR. Taking the mapping of the financial reporting domain with the four level hierarchy of the OMG into consideration, the studies by Chou and Chi (2010) and Spies (2010) are the most closely related to this study and can be viewed as complimentary to this study.

6.4.2 Model and Ontology Hierarchy of the CFfFR

Ontologies, as used in computing, overlap with conceptual modeling and links modeling theories and ontologies in the computing discipline. The OMG four level hierarchy provides an explanation of the role of the different models between data (M0), models (M1), metamodels (M2) and meta-metamodels (M3) (Figure 6.6). The role and function of the CFfFR can, according to the model theory of Kühne (2005; 2006b) and the OMG four level hierarchy, be classified as that of a meta-metamodel. Models, metamodels and meta-metamodels should adhere to logical and relational requirements and should represent their respective realities (R) in an acceptable and truthful manner in order to be truth-bearing models. The OMG four level hierarchy and model theory of Kühne (2005; 2006b) serve as theoretical background to understand and refine the role and function of the CFfFR and formal domain ontology of the CFfFR as metamodels.

The ontological relationship of upper ontologies and domain ontologies combined with the OMG four level hierarchy (Henderson-Sellers, 2011b; OMG, 2014; OMG, 2008) applied to the model relationships according to Kühne (2005; 2006b) in the financial reporting domain can schematically be illustrated as follows:

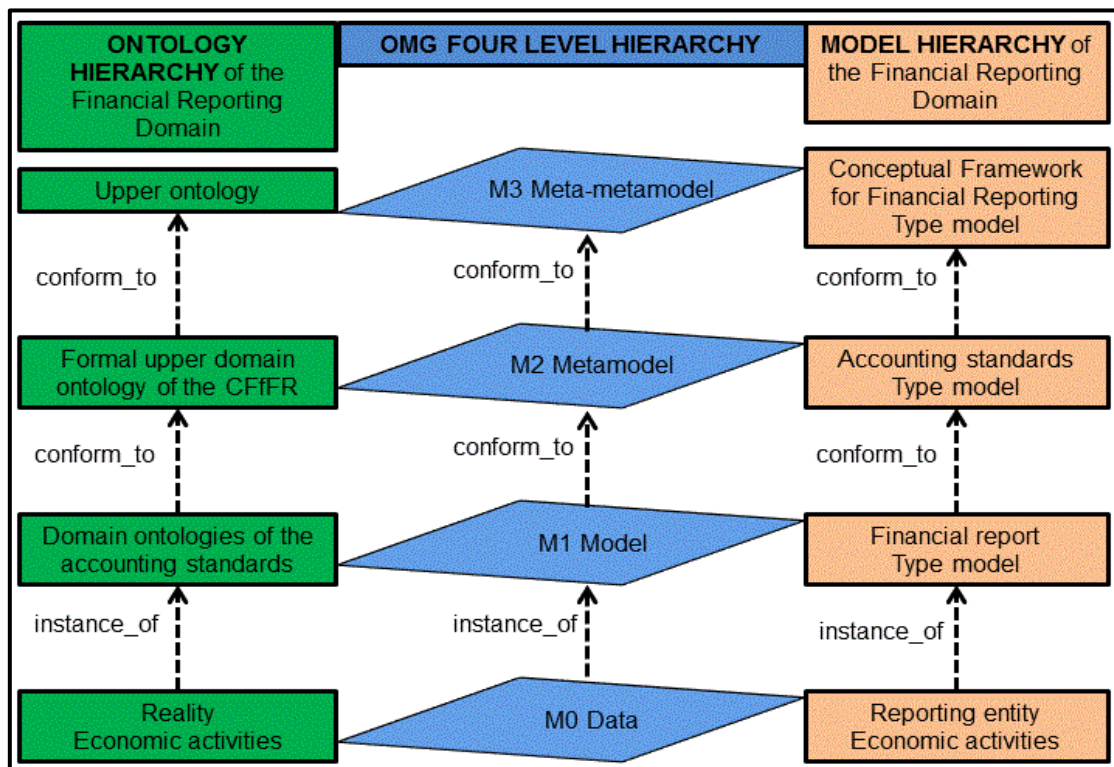


Figure 6.8: Ontology, OMG and model hierarchy of the financial reporting domain

According to the OMG four level hierarchy, models and metamodels should be in a one to many relationship providing a certain level of abstraction. The model should cover all the instances in the domain reality in order to adhere to the requirement of completeness and be a sound representative model of the reality. A model should conform to a metamodel on a higher level in order for the relationship between the model and the metamodel to form a logically coherent and consistent relation. If a metamodel and its related model on a lower level are both logically consistent and all the concepts and relationships in the lower level model is abstracted into the higher level metamodel, then a logically consistent relationship of representation exists between the two models. This logically consistent representative relationship makes it possible to understand and learn some truths of the reality domain that is being modelled.

The implication of the relational characteristics between models and metamodels for the ideal CFfFR is that the ideal CFfFR should in the first place be in itself logically consistent. Secondly, there should be a one to many relationship between the ideal CFfFR, the ideal accounting standards and evidently with the economic activities of a reporting entity. The ideal CFfFR should cover all the concepts and relationships within the ideal accounting standards and the instances in the reporting domain, on an abstract level. Thirdly, the ideal accounting standards should also be logically consistent. The ideal accounting standards should conform to the ideal CFfFR in order to provide a logically consistent, representative relationship between the ideal CFfFR as meta-metamodel and the ideal accounting standards as metamodels. This should result in a financial report of a reporting entity as model that conform to its metamodels to be a logically consistent representation of the reporting entity's economic activities that complies with the concepts and relationships as conceptualised in the ideal CFfFR and in the ideal accounting standards. In this scenario, the role and function of the ideal CFfFR are to serve as a role model (meta-metamodel) from which the ideal accounting standards can be derived. This ideal CFfFR should be a step closer towards a global CFfFR.

6.4.3 How Ontologies in Computing Help to Answer the Research Questions

The following is a list of characteristics of ontologies in computing and how they contribute to answering the research questions in this study:

- 1) Ontologies in computing offer the possibility to build an ontology using a formal language based on formal logic to ensure that the ontology is inherently logically consistent. This study took advantage of the use of the formal language OWL DL to test built a formal ontology of the CFfFR that is inherently logically consistent.
- 2) The formal language is computable making it possible to make computable inferences and test a complex conceptual system for internal consistency. The value of the formal domain ontology of the CFfFR is that it can draw inferences from the written text based on formal logic and confirm problems like inconsistencies and unintended meanings already suspected and indicate additional inconsistencies and unintended meanings not previously noted. The complex system of the formal domain ontology of the CFfFR was tested for

- internal consistency using the reasoner FACT++, making it possible to identify internal logical inconsistencies in the natural language text of the CFfFR.
- 3) The computability of the formal ontology makes it reusable and easy to adjust when changes occur. It also makes it easy to test alternative scenarios without having to redevelop the entire ontology. It was possible to test alternatives during the building process.
 - 4) The use of a formal language forces the ontologist to use the most basic concepts and relationships in an unambiguous manner. The meanings of the concepts and relationships must be explicitly clear to avoid logical inconsistencies. In order to build the formal domain ontology of the CFfFR it was essential to identify the most basic concepts and relationships within the CFfFR. It was also important to establish the exact and unambiguous meanings of the identified concepts and relationships in order to avoid logical inconsistencies.
 - 5) It offers upper ontologies based on sound philosophical assumptions to identify concepts and relationships. The philosophical assumptions regarding the most basic concepts and their relationships were used to build the formal domain ontology of the CFfFR.
 - 6) Ontologies in computing offer the possibility to build domain ontologies with the added benefit of linking to upper ontologies and domain ontologies. The OMG four level hierarchy, combined with the use of upper domain ontologies and domain ontologies in computing were used to map the ontology of the CFfFR in the financial reporting domain in terms of its role and status within the domain.
 - 7) Ontologies in computing offer the option to develop ontologies containing different modules in the case of complex conceptual systems. The computability of the ontologies built on formal languages makes it possible to test the logical consistency between different modules of a specific ontology. This option makes it possible to create formal domain ontology modules of the accounting standards and the CFfFR and test for logical consistency between the different modules.

The formal domain ontology of the CFfFR does not intend to replace current research and experience gained from practice, it can just be another research tool in the hands of researchers. The formal domain ontology of the CFfFR does not intend to replace the written text, it only serves as a tool to analyse the current text in order to indicate possible improvements in the text. In the words of Moonitz (1963:43) it has the potential to “extend our knowledge even to problems beyond anyone’s experience to date”.

A formal representation of the CFfFR is not a new way of doing science, it is only a new method. Abstraction of similarities from the mass of evidence has already been described by Moonitz (1963). A formal representation of the CFfFR is a higher level of abstraction of the statements, definitions and postulates presented in the CFfFR. It is a logical process of drawing inferences from the text either confirming previous knowledge or establishing new knowledge.

The function of the formal domain ontology of the CFfFR is not to prove if a statement, definition or postulate is either true or false. The ontology tests for logical consistency within or against the rest of the statements, definitions and postulates.

The domain experts should decide whether a statement, definition or postulate is either true or false.

6.5 Idealised Assumptions

The idealised assumptions derived from the previous chapters are summarised and categorised. The categories are: main assumption, assumptions regarding the financial reporting domain, assumptions regarding the role and status of the CFfFR, assumptions on the requirements for a global CFfFR and lastly assumptions on the influences on setting the ideal CFfFR. In total 13 idealised assumptions provide the background for the ideal CFfFR to function as a truth-bearing model.

Main assumption:

1. A globally accepted CFfFR is possible.

Domain assumptions:

2. The semantic domain modelled in this study is the definitions and other fundamental concepts providing guidance for globally acceptable financial reporting.
3. The ideal CFfFR provides all the definitions and other fundamental concepts needed to guide standard setters to set principle-based globally acceptable accounting standards.
4. The definitions and other fundamental concepts are restricted to those definitions and other fundamental concepts needed to guide the setting of principles to provide information needed by primary users of general-purpose financial statements to make decisions.

Role and status assumptions:

5. The ideal CFfFR serves as a meta-metamodel and has a deductive status towards accounting standards and consequently, has a prescriptive role towards accounting standards.
6. Definitions of the elements of financial statements and other fundamental concepts can be applied both inductively and deductively on economic instances. The same results are accomplished regardless of the direction of application of the definitions and fundamental concepts.
7. Given the deductive status of the ideal CFfFR, accounting standards are logically and internally consistent with the ideal conceptual framework.
8. The ideal CFfFR satisfies the needs of practitioners, requirements of legislators, and theories of academics.

Requirements assumptions:

9. The ideal CFfFR is internally and logically consistent.
10. The ideal CFfFR is clear and free of unintended meanings.

Influences on setting the idealised conceptual framework:

11. The ideal CFfFR is not the result of responses to economic, technological, political or legislative stimuli.
12. Existing accounting standards do not influence the formulation of definitions and other fundamental concepts in the conceptual framework.
13. There are no political influences and regulatory restrictions on creating the ideal conceptual framework.

The formal domain ontology of the CFfFR developed in this study contributes towards addressing to the following idealised assumptions: domain assumptions 2 and 4, requirement assumptions 9, 10 and 11.

By addressing the idealised assumptions above the formal ontology of the CFfFR may at least partially contribute towards reaching the following idealised assumptions: Main assumption; domain assumption 3; role and status assumptions 5, 6, 7 and 8.

The following idealised assumptions are not addressed by building the formal domain ontology of the CFfFR developed in this study: Influence assumptions 11, 12 and 13. The influence assumptions fall outside the scope of influence of this study.

The motivation and benefit of building a formal domain ontology of the CFfFR were discussed in Chapter 6. In Chapter 7, it is reported how the formal domain ontology of the CFfFR was built. The results of the ontology are reported in section D.

6.6 Knowledge Contribution

The knowledge contribution towards building the formal domain ontology of the CFfFR as the main artefact in DSR Cycle 4 was advanced during DSR Cycle 3 with the addition of two more artefacts. The two artefacts, the role of the ideal CFfFR as a formal domain ontology according to the OMG four level hierarchy (Figure 6.6) and the construct artefact the conceptualisation on how a CFfFR ontology could contribute towards answering the research questions, contribute to the knowledge on how to build a CFfFR that could be globally acceptable. These artefacts represent evaluation markers on the FEDS Human Risk & Effectiveness evaluation strategy. The progress on the FEDS Human Risk & Effectiveness evaluation strategy is schematically illustrated in Figure 6.7.

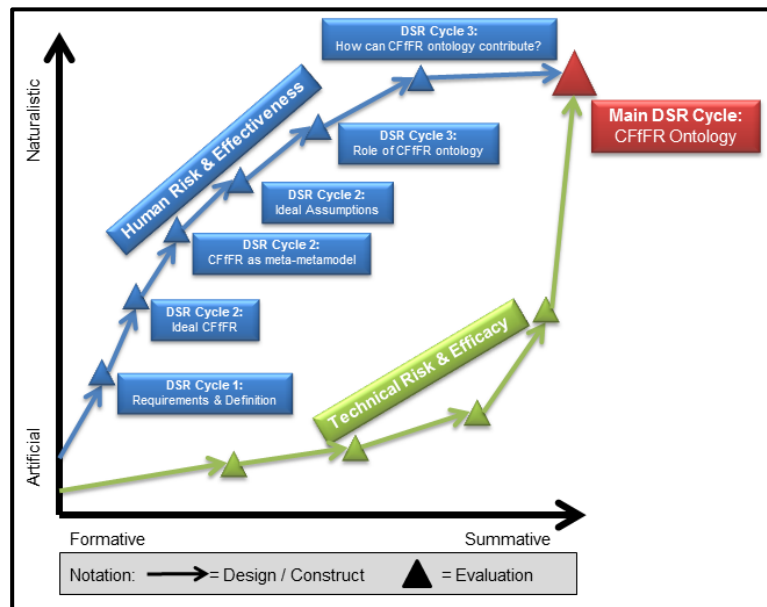


Figure 6.9: FEDS Strategy - DSR Cycle 3

With the development of the model artefact and construct artefact during DSR Cycle 3, the FEDS Human Risk & Effectiveness strategy is completed. The theoretical background and assumptions to build the formal domain ontology of the CFfFR was established.

6.7 Conclusion

During DSR Cycle 3, as reported in Chapter 6, the relevance of ontology from a philosophical perspective and ontology technologies from a computing perspective was explored to motivate the building of a formal domain ontology of the CFfFR. The third sub-research question was answered in Chapter 6, indicating how the formalisation of the CFfFR using ontologies could assist in constructing a CFfFR that would be closer to the ideal CFfFR and would adhere to more of the requirements and ideal assumptions of a globally acceptable CFfFR.

The use of a formal language and the necessity of logical consistency to obtain cross-cultural acknowledgement of a theory was argued from a philosophical perspective in section 6.2. From a computing perspective, the role of the CFfFR as a conceptual model where it functions as a formal upper domain ontology was indicated in section 6.3.

In section 6.5, the idealised assumptions for the ideal CFfFR was presented. It was indicated in section 6.5.1 which idealised assumptions will be addressed by building a formal upper domain ontology of the CFfFR. In section 6.5.2, the idealised assumptions not addressed by the formal upper domain ontology of the CFfFR were listed.

Based on the knowledge that a formal upper domain ontology of the CFfFR would contribute towards the construction of a CFfFR that would adhere to more of the requirements of a global CFfFR, the study proceeded towards the next DSR Cycle, the actual building of a formal domain ontology of the CFfFR in Chapter 7.

CHAPTER 7

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7 A FORMAL DOMAIN ONTOLOGY OF THE CFfFR

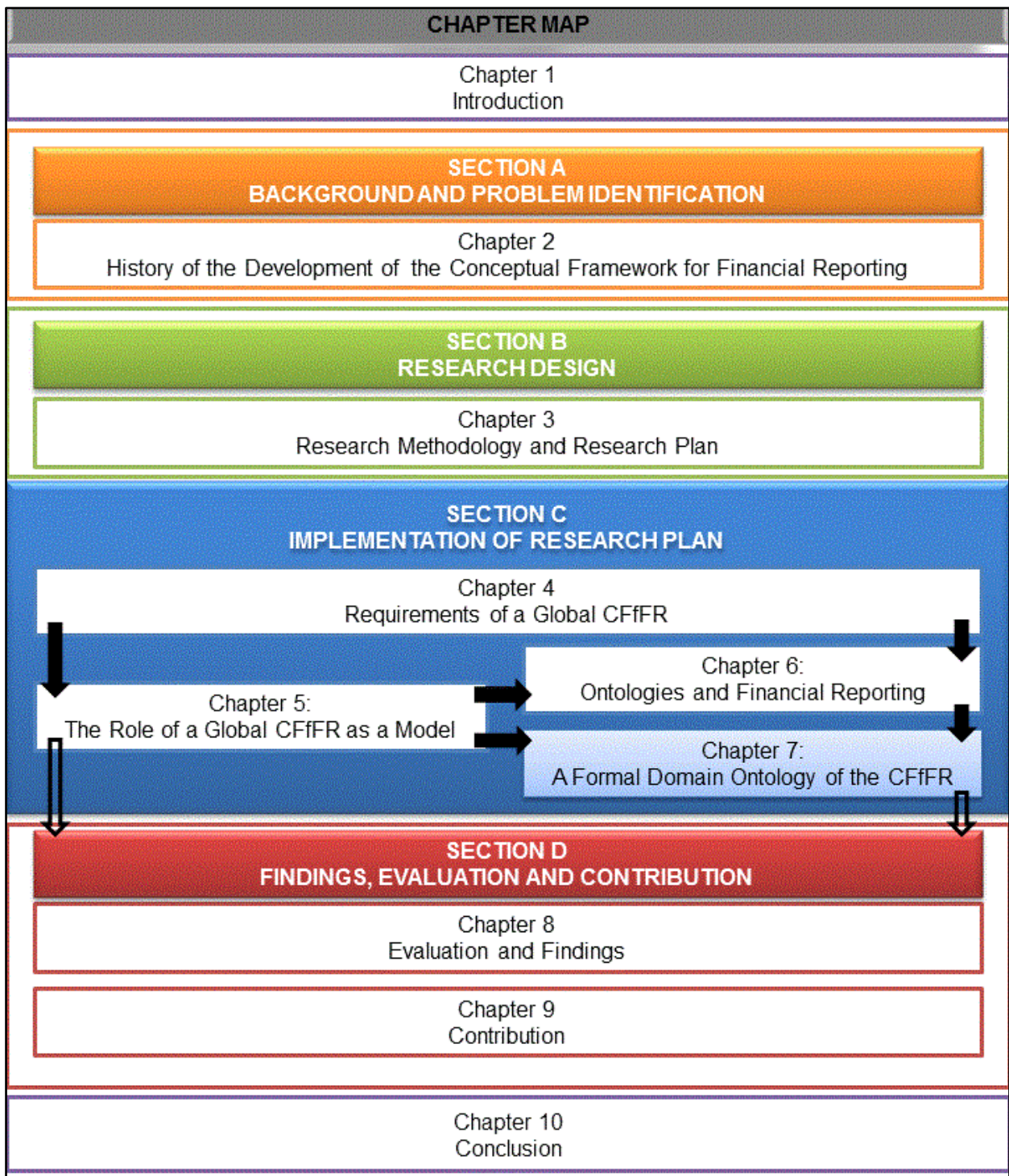


Figure 7.1: Chapter map - Chapter 7

7.1 Introduction

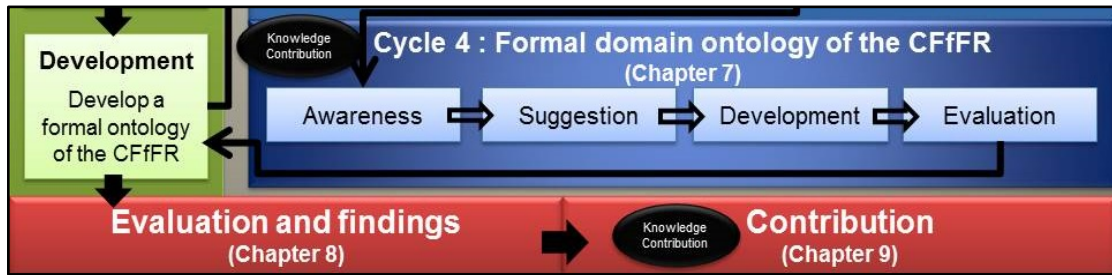


Figure 7.2: DSR Cycle 4

In DSR Cycle 3 (Chapter 6) it was established that a formal domain ontology of the CFfFR would contribute towards the construction of a CFfFR that could adhere to the requirements of a global CFfFR. An overview of the structure of Chapter 7 is provided in Figure 7.3.

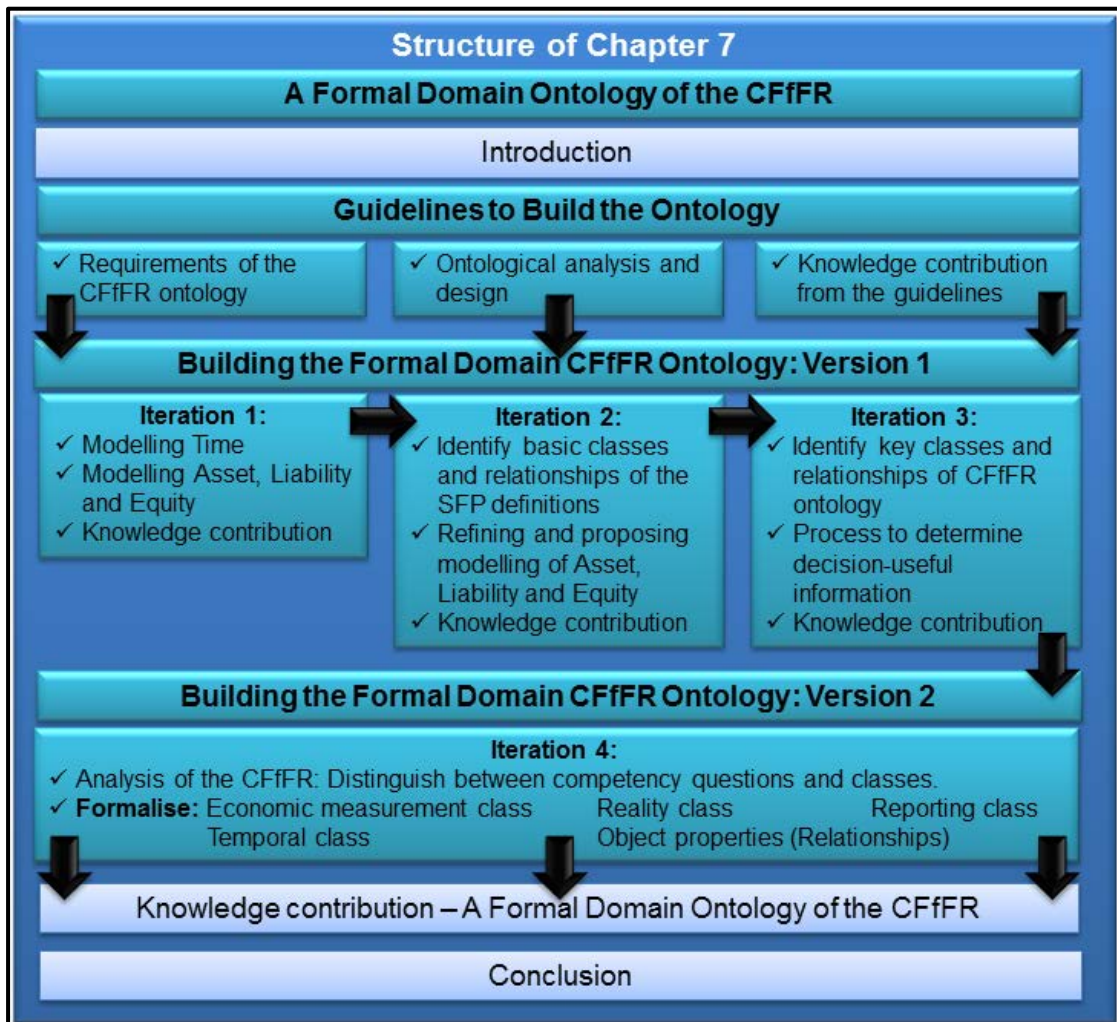


Figure 7.3: Structure of Chapter 7

DSR Cycle 4 is the last cycle of the DSR strategy (Figure 3.3 and Figure 7.2) and is reported on in Chapter 7. In DSR Cycle 4 the awareness (section 3.6.5) of the applicability of ontology from a philosophical perspective and ontology technologies as used in computing¹⁰⁵ on the CFfFR resulted in the suggestion to build a formal domain ontology of the CFfFR (*R*) (Guarino, 1998; Mäki, 2011). During the Development Step, the ontology of the CFfFR was built according to the requirements of the Ontology Life Cycle (OLC) Model (section 7.2.1) as proposed by Neuhaus et al. (2013). The CFfFR ontology is the artefact *output* of the Development Step (Figure 7.2) of DSR Cycle 4. The artefact is *evaluated* against the requirements of a global CFfFR (DSR Cycle 1, reported in Chapter 4) to determine if the CFfFR ontology adheres to more of the requirements of a global CFfFR determined during DSR Cycle 1 (Chapter 4). The role of the formal ontology of the CFfFR is also *evaluated* against the idealised assumptions (section 6.5) to determine if the ontology of the CFfFR contributes towards the ideal CFfFR and can serve as a truth-bearing model for the financial reporting domain.

The CFfFR ontology consists of two versions. The two versions were built by going through four iterations and were partially reported on in publications (Gerber et al., 2014; Gerber, Gerber, Van der Merwe, & Stegmann, 2015; Gerber, Gerber, & Van der Merwe, 2015). During Iteration 1 the formalisation of the statement of financial position elements were explored and reported on in Gerber et al. (2014).

During Iteration 2, the work done in Iteration 1 was expanded to include suggestions from the Discussion Paper issued by the IASB on the CFfFR (IASB, 2013a). The basic classes and relationships present in the financial position elements were identified and used to formalise the respective definitions. In Iteration 2, definitions for asset, liability and equity that are logically consistent and that address some of the problems identified during the first iteration, were suggested. This work was published in the conference proceedings of the SAAA conference for 2015.

During Iteration 3, the CFfFR as a whole was considered for formalisation, at which point it was noted that a lot of domain knowledge is implied in the CFfFR regarding the fundamental concepts involved and the decision process to be able to publish financial reports. A decision filtering process was developed (Figure 7.19) during Iteration 3 and was reported on and presented at the AMCIS 2015 conference in Puerto Rico.

During Iteration 4, the knowledge obtained from the previous three iterations was used to develop the CFfFR ontology as presented in this study. During Iteration 4, the competency questions to be answered by the CFfFR ontology was refined and the CFfFR was analysed to determine which classes of the financial reporting domain should be included in the CFfFR ontology and which information contributes towards the competency questions. The main purpose of the CFfFR is to provide decision-useful information to the users of financial reports. After the analyses of the CFfFR,

¹⁰⁵ *Computing* is used to refer to both Computer Sciences and Information Systems.

as summarised in Figure 7.21, the competency questions were aligned to serve the main purpose.

Chapter 7 consists of the following:

- internationally suggested guidelines to build an ontology (section 7.2),
- modeling of time for the purpose of financial reporting (section 7.3),
- a first attempt to formalise the definitions of the elements of financial reporting (section 7.3),
- identification of basic classes and relationships in the financial position elements and propose internally coherent, logically consistent and unambiguous SFP definitions (section 7.4),
- identification of key classes and relationships and developing a decision filter for financial reporting ontology (section 7.5), and
- refining the competency questions and building a CFfFR ontology to support decision-useful information for financial reporting (section 7.6).

7.2 Guidelines to Build an Ontology

The OLC Model used in computing technologies to build an ontology (section 3.8.3, Figure 3.8) was adopted and adapted to develop a rigorous modeling technique to build a formal ontology of the Target *R* domain (the CFfFR, Figure 5.6). The modeling technique is used to test the CFfFR against the idealised assumptions, requirements and role a global CFfFR.

The development of an ontology-based formal language for a domain commences with the construction of an ontology formally capturing the basic **classes**¹⁰⁶ and **relationships** of the domain. In order to formally model or capture the knowledge of the specified domain (*R*) (the CFfFR) as well as the relevant classes and relationships in the domain, the different entities of a system were organised into its key classes and relationships between those classes (Guarino et al., 2009). A taxonomy of the classes of a system or domain forms the backbone of an ontology (Guarino et al., 2009). The natural text in the CFfFR documentation served as the main source of knowledge for the CFfFR ontology development. During Iteration 3 of Version 1, it became evident that a specimen financial report should also be included as a source document to help identify and formalise key classes and concepts supporting decision-useful information in the CFfFR ontology.

As a development approach during the DSR Development Step, an ontology engineering approach, described by Horridge (2009) and Noy and McGuinness (2000) was incorporated that consists of the following steps:

- Identification of the classes and class hierarchy, including disjointedness;
- Addition of all the relationships (object properties) between classes;
- Refinement of classes based on the relationships that they participate in;
- Identification of definitions;

¹⁰⁶ See section 7.2.1 for a discussion on the use of classes and concepts in ontologies.

- Addition of annotations, which are used for meta-data or descriptions of anything that is modelled;
- Refinement of the ontology through various iterations of the above steps.

The four iterations of the CFfFR ontology went through the steps as indicated by Horridge (2009) and Noy and McGuinness (2000). The ontology engineering approach by Horridge (2009) and Noy and McGuinness (2000) were incorporated in the OLC Model and used during the various phases of the OLC Model. As the OLC Model was discussed in detail in section 3.8.3, only the phases utilised in this study are indicated below.

7.2.1 OLC Phase 1: Requirements of the CFfFR Ontology

Phase 1 of the OLC Model started during DSR Cycle 1 with the determination of the content requirements of a global CFfFR. The first requirement is that the CFfFR ontology should comply with the main objective of the CFfFR identified as decision-usefulness (section 4.6.1d). Decision-usefulness was identified as the main competency question to be answered by the CFfFR ontology. The key classes and relationships should contribute towards providing decision-useful information to the users of financial reports to comply with the objective of the CFfFR.

The ontology must contain the most fundamental classes and relationships of principles providing decision-useful financial information to the primary users of financial reports. The following are the **competency questions** answered by the CFfFR ontology:

- (1) *What are the fundamental classes and relationships of principles providing decision-useful information to the primary users of financial reports?* The different classes and relationships were identified and refined through all four iterations. The final version is schematically illustrated in Figure 7.28, Figure 7.29 and Figure 7.30.
- (2) *What are the formal definitions of the fundamental classes to provide decision-useful information to the primary users of financial reports?* The definitions of the fundamental classes were mainly adopted from the CFfFR as it represents the shared domain knowledge. In cases where modeling decisions were made, annotations were added to the Protégé file to explain the use of terminology.
- (3) *What is the class hierarchy of the fundamental classes to provide decision-useful information to the primary users of financial reports?* The class hierarchy were refined throughout the formalising process and is presented in Version 2, Iteration 4 (section 7.6).

The competency questions above were formalised to adhere to the idealised assumptions (section 6.5) in order for the CFfFR ontology to function as a truth-bearing model.

The **content requirements** (section 4.6.2) were identified as the fundamental requirements the CFfFR ontology should adhere to in order to contribute towards the CFfFR ontology being a truth-bearing model (section 5.2.4).

- The CFfFR ontology should be complete and comprehensive (section 4.6.2). The CFfFR ontology should formalise all the fundamental key classes and relationships of the financial reporting domain to adhere to the `conform_to` relationship in the CFfFR ontology hierarchy (Figure 6.6).
- The CFfFR ontology should be internally coherent (section 4.6.2). The relationships between the classes should be well defined to form a coherent system supporting the main competency question.
- The CFfFR ontology should be clearly and unambiguously formulated (section 4.6.2). The classes and relationships of the definitions and fundamental concepts should be so precisely defined that it can be interpreted in only one way and without unintended meanings.
- The CFfFR ontology should be logically consistent (section 4.6.2). The relationships between classes should pass the test of logical consistency when tested with the reasoner.
- The CFfFR ontology should be able to indicate inconsistencies and unintended meanings of the natural text of the CFfFR to the target audience of the CFfFR ontology.

The scope of the CFfFR ontology is the financial reporting domain as portrayed in the natural text of the CFfFR and a specimen financial report. As there are no existing ontologies of the CFfFR or the financial reporting domain (section 6.4), this study is a first attempt to formulate a CFfFR ontology.

7.2.2 Ontological Analysis, Design and Development and Basic Assumptions to Build a Formal Ontology of the CFfFR

a) *OLC Phase 2: Ontological analysis*

During the Ontological Analysis Phase 2 of the OLC (Figure 3.8), the key entities (individuals, classes and the relationships between them) were identified. The key entities were linked to the domain terminology. Unintended meanings, inconsistencies and implied domain knowledge were identified during this Phase. Phase 2 of the OLC is reported on in sections 7.3, 7.4 and 7.5.

A formal ontology / formal language consist of assertions about **classes** and the **relationships**¹⁰⁷ between the classes within a specified semantic domain

¹⁰⁷ According to Corazzon (2013:Theory and History of Ontology) "in doing ontology one always selects the most important and most general laws among all the laws which the various disciplines have to offer at any given time. Further, the ontologist interprets and generalizes those laws and must endeavour to establish the most fundamental and general structures of our world". Knowledge objects in an ontology "are described in terms of concepts (generic or

(accounting). The reasoner, based on DL, infers logical consequences of the assertions made about the domain and checks, for instance, if these assertions are consistent. In order to build a logically consistent ontology the *exact meaning* of the classes and relationships needs to be asserted formally and without any doubt. Should the modeller doubt the meaning of a specific class or relationship during the ontology construction process, it is usually an indication of an ambiguity. This forces the modeller to make some assumptions about the meaning in order to state the assertion formally.

Therefore, in order to build the formal ontology based on a formal language, the semantic domain has to be analysed to identify the **most basic classes and relationships** and most general laws within the specified (accounting) domain (Corazzon, 2013). Knowledge objects in an ontology “are described in terms of classes (generic or instantiated) which are connected through semantical relationships” (Mineau, 1993:94). This should be the classes and relationships of the most basic postulates of accounting.

When these principles are applied to the financial reporting domain, the CFfFR already provides an interpretation and generalisation of the most fundamental structures of financial reporting. The ontologist should then interpret and generalise those classes and relationships in order to formalise it (Corazzon, 2013).

Concepts or classes in ontologies

The basis of the ontology is to analyse the financial reporting domain (as portrayed in the CFfFR) into concepts / classes and the relationships between those concepts / classes. The word concept is used 21 times in the CFfFR, excluding when it is used as part of the title Conceptual Framework, indicating the importance of the notion “concept”. As the use of the word concept is essential in the CFfFR it is important that the use of “concept” in this study is clearly stated.

The following meanings are provided in dictionaries for the notion “*concept*”. According to *Collins English Dictionary (2015)*:

As a noun

1. an idea, especially an abstract idea ⇒ the concepts of biology
2. (*philosophy*) a general idea or notion that corresponds to some class of entities and that consists of the characteristic or essential features of the class
3. (*philosophy*)
 - a. the conjunction of all the characteristic features of something
 - b. a theoretical construct within some theory
 - c. a directly intuited object of thought
 - d. the meaning of a predicate

instantiated) which are connected through semantical relations” (Mineau, 1993:94). According to Basili and Pazienza (Basili & Pazienza, 1993:162) “much of the lexical information on verb semantics is entrusted to conceptual relations”. When these principles are applied to the financial reporting domain, the CFfFR already provides an interpretation and generalisation of the most fundamental structures of accounting.

4. (*modifier*) (of a product, a car) created as an exercise to demonstrate the technical skills and imagination of the designers, and not intended for mass production or sale.

According to the *Cambridge Dictionaries Online* (2015) concept is a “principle or idea” and the *Oxford Dictionaries* (2015) provide the following meanings of concept:

1. “An abstract idea: structuralism is a difficult concept, the concept of justice
2. Philosophy: An idea or mental image which corresponds to some distinct entity or class of entities, or to its essential features, or determines the application of a term (especially a predicate), and thus plays a part in the use of reason or language.”

The *Miriam-Webster Dictionary* (2015) defines concept as :

1. “: something conceived in the mind : thought, notion
2. : an abstract or generic idea generalized from particular instances.”

When these definitions are analysed the following are repeated when “*concept*” is used as a noun: idea, abstract idea and general idea. When the word concept is used with a philosophical connection, characteristic feature, essential feature or particular instances are repeated in the definitions. It seems like a concept can be described as a general or abstract idea (mental image) consisting of characteristic or essential features. This definition, although it corresponds with the dictionaries consulted, is still not exact enough when used in a process where terminology is standardised in the CFFR ontology.

Klein and Smith (2010), involved in terminology standardisation for ontologies, stated that the term “concept” is one of the most misused terms used in technical standards. The use of the term by realists, conceptualists and nominalists are indicated to support their argument. The problem is that readers import their own expectations of what the term means even when the term “concept” is used for one specialist community, thus creating confusion within that community. After a discussion regarding the use of the term “concept” and related terms such as “concept definition”, “concept system”, and “concept system node” Klein and Smith (2010) recommended that in ontologies “instances” and “types” as two kinds of reality entities provide better alternative terms.

An “instance” in ontology language refers to an “individual” or a “particular”, but it is preferred to refer to the term “instance”. “Instances draws attention to the fact that entities in question are *instances* of corresponding *types*” (Klein & Smith, 2010:8). Alternatives for “type” are “universal” and in realist philosophy and ontology also called: “class”, “kind”, “category”, “genus”, “species” and “taxon”. Klein and Smith (2010) propose that the term “class” is used to refer to collections of instances. In this study, the term “class” is used to describe a collection of instances. A further reason for using the term “class” is that class is used in Protégé thus avoiding confusion between the terms concept and class.

“Type” in relationship to “class” indicates a certain type of class. For example, mammal is a class and dog is a type of mammal. If we relate it to accounting, it can

be explained as follows: asset is a class and fixed asset is a type of asset. Classes are categorised based on the characteristics of the instances. Distinctive characteristics of instances will differentiate between different types represented by a class with corresponding characteristics of instances grouping types under a single class. Once the classes and relationships were identified, these classes and relationships were formalised during Phase 3 of the OLC model.

b) OLC Phase 3: Ontology design

The ontology design was based on the classes and relationships identified during Phase 2. Description Logics (DL's) and OWL 2 were used to formalise the classes and relationships of the CFfFR. The current ontology is not separated into modules. The ontology of the CFfFR may serve as a basic module should accounting standards be formalised at a later stage. After Phase 3 the ontology were developed according to Phase 5 of the OLC Model.¹⁰⁸

c) OLC Phase 5: Ontology development and reuse

The ontology Development Phase 5 consisted of four activities: (1) informal modeling, (2) formalisation of competency questions, (3) formal modeling and (4) operational adaptation.

Activity 1: Informal modeling:

During informal modeling the individuals, classes and their relationships were identified and terminology of the domain were mapped to them (Neuhaus et al., 2013). The results of the informal modeling were used to formalise the scenarios and competency questions. The idealised assumptions (section 6.5) were also used to test the informal and formal modeling processes to evaluate if the ontology contributes towards the ideal CFfFR. The results of the formalisation of the competency questions are presented in section 7.6.2.

Activity 3: Formal modeling:

During the formal modeling of the ontology, the classes and their relationships were captured in the ontology language OWL and D.L. The results of the formal model were evaluated by determining if the "ontology represents the domain appropriately (fidelity), adheres to the design decisions made in the Ontology Design Phase (craftsmanship), and is supposed to meet the requirements for domain representation (fitness)" (Neuhaus et al., 2013:10).

Evaluating fidelity

One of the basic assumptions adopted in this study is that the CFfFR represents the most basic classes and relationships regarding the financial reporting domain (section 7.2.2). As the CFfFR forms the basis document to

¹⁰⁸ A reminder that the ontology did not form a system therefore Phase 4 was not part of the cycle.

guide the ontology of the CFfFR, the assumption is that the ontology elements are correct according to the accepted document (CFfFR) within the accounting community. The domain is viewed at a very high level from a document prepared by some of the most experienced and well-recognised domain experts – the IASB. This study focused mainly on the evaluation of the logical consistency and clarity of the natural text by formalising the classes and relationships of the financial reporting domain as formulated in the CFfFR. Because of the evaluation process, some remarks were also made on the completeness of the CFfFR.

Evaluating craftsmanship

Craftsmanship is evaluated by looking at two aspects, established best practices and if design decisions were followed in the development process (Neuhaus et al., 2013). Iteration 4 does not include the use of an upper ontology such as DOLCE, but is based on a process of naming conventions explained in the OWL-DL pizza ontology (Rector, Drummond, Horridge, Rogers, Knublauch, et al., 2004).

The ontology is evaluated based on “mathematical and logical properties such as logical consistency, graph-theoretic connectivity, model-theoretic interpretation issues, inter-modularity mappings and preservations” (Neuhaus et al., 2013:10). As this study does not include modules, the model-theoretic interpretation issues and inter-modularity mappings criteria are not applicable.

The results of the Formal Modeling Phase are reported on in Chapters 7, 8 and 9.

Evaluating fitness

The competency questions (section 7.2.1, a), vii), idealised assumptions (section 6.5) and research questions (section 3.2) form the basis to evaluate if the ontology meets the model requirements and ultimately answer the research questions. The results and findings of the ontology are presented in Chapters 8 and 9.

Activity 4: Operational adaptation

In order to have an operational ontology, the ontology is adapted to the operational requirements during the operational adaptation activity. The concern is whether the ontology will respond within a time-frame that meets its performance requirements (Neuhaus et al., 2013). The operation adaptation activity is not important during this study as it is not part of the study to deploy the ontology.

Is the chosen ontology language expressive enough to meet the ontology requirements?

During the Development Step cycles of the DSR project, Protégé 4.3 with bundled reasoners (e.g. FACT++ and Pellet) were used as tools to develop an OWL 2 ontology (W3C, 2012). OWL 2 functions as a formal language for the selected basic definitions of the core elements necessary in the CFfFR. Currently OWL 2 as based on DL's are deemed expressive enough to meet the ontology requirements.

d) *Basic assumptions adopted*

For this research study the following assumptions were accepted:

- Assume that the CFfFR should encapsulate the most basic definitions and principles (postulates) necessary for the development of financial accounting standards;
- Assume the position that the textual representation of the CFfFR, given its supposed role, is sufficient without any further explanations. It should not be necessary to explain concepts or statements from third party sources. If an explanation is needed it is an indication of an unintended meaning or implicit domain knowledge imbedded in the natural text and it was reported as such;
- Use only the current textual representation of the CFfFR to develop the formal language and ontology. Should the textual representation be insufficient it is an indication of an incomplete representation of the financial reporting domain and an incompleteness were reported.
- Regard situations where the published text is unclear, ambiguous or inconsistent as omissions and propose that this should be amended;
- Accept the textual description as presented in the CFfFR, but suggest that this could be augmented with an ontology-based formal language where the semantics are captured unambiguously;
- Suggest that, if inconsistencies, ambiguities, implicit domain knowledge and incompleteness exist, they do not necessarily have to be solved as the solution may be complex, but they should at least be known.

7.2.3 Knowledge Contribution: Basic Assumptions and Ontology Life Cycle Model

In section 7.2 it was indicated how the OLC Model was used to build the CFfFR ontology. The basic assumptions were documented in section 7.2.2. The guidelines to build the ontology CFfFR serves as the construct output in the Development Step of DSR Cycle 4 and is the first point of contribution in the FEDS Technical Risk & Efficacy evaluation strategy. The knowledge contribution is that the requirements, according to the OLC Model and basic assumptions, provide the technical platform to successfully build the CFfFR ontology. Figure 7.4 provides an overview of the role of the first artefact during the building process in the FEDS Technical Risk & Efficacy evaluation strategy.

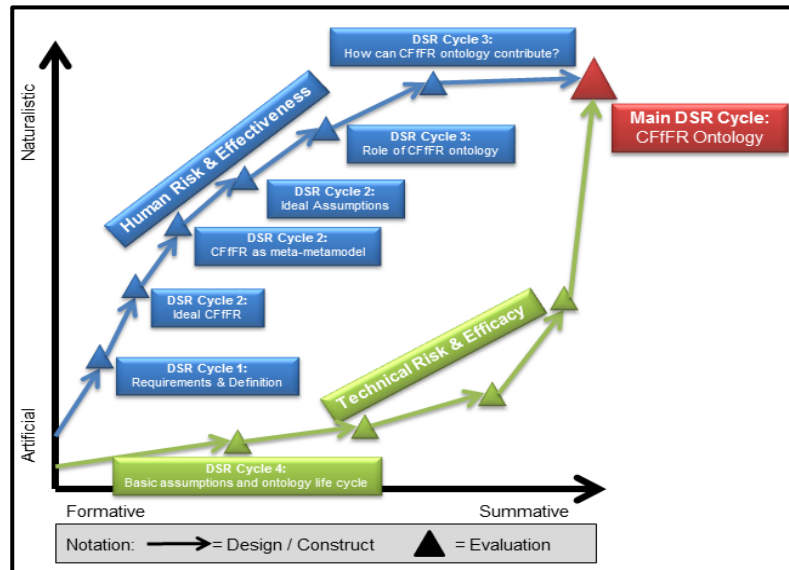


Figure 7.4: FEDS Strategy - DSR Cycle 4, Construct artefact.

7.3 Building the CFFR Ontology: Version 1 - Iteration 1

The purpose of Iteration 1 was to determine if it is possible to formalise the definitions of the elements portrayed on the statement of financial position. This iteration provided valuable information regarding the problems to be encountered when a definition written in natural text is used as source to formalise the basic classes and relationships communicated in the natural text. The definitions for asset, liability and equity are the foundation of a financial report as is evident from Chapter 2 where it was indicated how the SFP dominated financial reporting through history. The notion of time plays key role in accounting. In building an ontology of the CFFR the modeling of time plays an important role as time serves as decision point in accounting.

7.3.1 Modeling of Time: Past, Present and Future

Adding temporal dimensions to OWL is not straightforward as OWL's specific logic-based formalism does not support the modeling of dynamically changing information (Krieger, 2008). OWL supports only unary and binary predicates and relationships cannot directly be equipped with temporal arguments (O'Connor & Das, 2011). Several solutions to the modeling of time in OWL have been proposed in literature, either by equipping the formal semantics (Artale, Guarino, & Keet, 2008; Lutz, Wolter, & Zakharyashev, 2008; Krieger, 2008), or through modeling constructs (Hobbs & Pan, 2004; Ma, 2007; O'Connor & Das, 2011). An ontologist would choose a solution based on the requirements that the ontology should fulfil.

In the basic definitions of the CFFR, the classes `Past`, `Present` and `Future` are pertinent. For the first version of the ontology artefact, a modeling solution was adapted, namely the basic temporal constructs of Hobs and Pan (2004) that defines (only) two classes of `TemporalEntity` namely `Instant` and `Interval`. The

predicates `begins` and `ends` are the relationships between `Instant`s and temporal entities, which are called `temporalBegins` and `temporalEnds` in this ontology. The granularity of `Instant` is not specified, and can, for argument sake, be a date e.g. the reporting date. The work of Hobs and Pan (2004) allows for several formalisms regarding time and at this stage seems to be appropriate for the modeling that is required for the ontology artefact.

The CFfFR definitions do not clearly state what is meant with `Past`, `Present` and `Future`. It would be straightforward to assume that `Past` and `Future` are `Intervals`. Part of the ontology is to clearly state the meaning of terms. Terminology related to time is inherently problematic as indicated by Russell (1970). `Present` is an indication of the present moment, but it is an ambiguous particular because the present is always changing (Russell, 1970). `Present` as used in the definitions is problematic. Does `present` in the definitions refer to the current present moment, the present moment when the financial report was drafted, the present moment as the date indicated on the financial report, or the present moment when the transaction was conducted? The definitions should be able to provide guidance at any stage during the financial reporting process.

For the first version of the ontology, the ontological choice was made to model `Present` as an `Instant`, with a member (individual) `TimeOfConsideration`. `Past` then has a `temporalEnd`, which is the `TimeOfConsideration`, and `Future` `temporalBegins` at the `TimeOfConsideration`.

In the second iteration `TimeOfConsideration` served as `Instant` and was replaced by `DateOfReporting` instead of `Present` as preferred. In discussions with accounting professionals, the use of `DateOfReporting` for `Present` was criticized. The professionals correctly indicated that the decision to include an economic activity (transaction) could not be limited to the reporting date, as it should be included in the accounting records from the moment it complies with the specific definition and recognition criteria. During iteration 3 and 4 (sections 7.6 and 7.7) the class name was changed to `ConsiderationDate` in the ontology. Therefore, in this study `ConsiderationDate` refers to the instant whenever the inclusion or exclusion of an element is considered. This implies that it may, for example, be the time when a contract is concluded, the reporting date, when an obligation is settled or an asset derecognized.

This solution introduced nominals into the ontology, which could influence reasoning performance, but the reasoning was still deemed sufficient for the purposes of the ontology. See a schematic presentation of the notion of time in Figure 7.5.

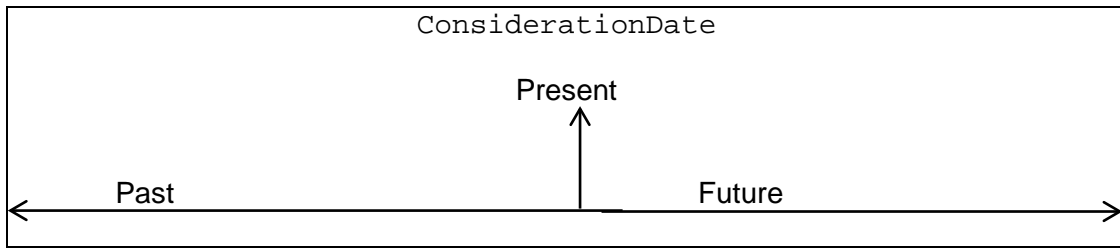


Figure 7.5: Presentation as an Instant (ConsiderationDate), with Past and Future as related Intervals.

The temporal class was expanded during Iteration 4 (section 7.7) to include ReportingDate in the ontology when it is specifically referred to as the date of a financial report. The classes PresentReportingDate, PastReportingDate and FutureReportingDate were created to differentiate between different reports and to be able to formalise for example when a previous reporting period started and when a current reporting period ends. The classes FutureTemporalInterval and PastTemporalInterval were introduced to indicate future and past reporting periods. These classes were deemed necessary in order to be able to distinguish between

- LongtermFutureReportingPeriod,
- CurrentFutureReportingPeriod, and
- PastReportingPeriod.

A TemporalClass was created in Protégé to formalise the notion of time. Figure 7.6 is an illustration of how time was formalised as TemporalClass.

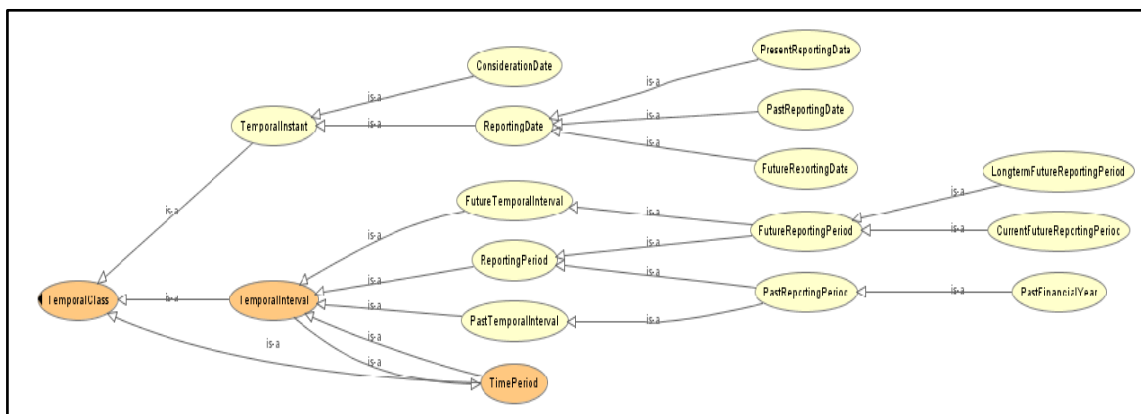


Figure 7.6: TemporalClass is_a relationships

The temporal class assertion as indicated in Figure 7.6 seems to be sufficient to capture the use of time periods and time instances as portrayed on a financial report.

7.3.2 Modeling the Definition for Asset

The definition for asset according to the CFfFR (IASB, 2010a:4.4 (a)) is formulated 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.”

When the definition for asset was analysed, the following basic classes were identified: `Resource`, `Entity`, `Event` and `Benefit`. These classes are marked as disjoint from each other. Disjointedness means that classes labelled as “disjoint” are separate and cannot form part of another disjoint class. A `Resource` cannot be a part of, or be a sub-class of an `Entity` or an `Event` or a `Benefit`. A `Resource` can be in a relation¹⁰⁹ to an `Entity` and all other disjoint classes.

The meaning of `Resource` is not explained in the CFfFR leaving it open for interpretation to the reader. A decision was made to use the class `Resource` without trying to explain the meaning as it could have different meanings to different readers. The lack of an exact meaning for `Resource` indicates that the interpretation of `Resource` can lead to some unintended interpretations.

`Resource` is accepted to be the most basic and broadest class for “something” that can be used by a reporting entity to advance its business objectives. In philosophical terms, it can be called a “universal” in the financial reporting domain. From the ontologist’s perspective, there are numerous resources in the world but only a few, adhering to certain criteria, can be used by a reporting entity to advance that specific reporting entity’s business objectives.

When considering the meaning of entity it is assumed that the class `Entity` refers to the Reporting Entity.

The class `Control` is implied because control over a resource is implied as the result of a past event. Modeling control as a class implies that `Control` should relate to `Entity` by introduction of an object property (relation). `Entity` relates to `Control` via `hasTypeOfControl`. `Resource` relates to `Control` via `isControlledBy`. This means that a `ControlledResource` is a `Resource` that `isControlledBy` a `Control`.

In the definition of an asset the class `Benefit`, a sub-class economic benefit was identified. There can be many benefits in the world, but in the definition of an asset, the class `Benefit` is specified as an `EconomicBenefit`. The exact meaning of an economic benefit is not clear from the text. Domain knowledge is assumed regarding the meaning of what an economic benefit is. The question that needs an agreed upon answer provided by domain experts is: “What is an economic benefit?”

The use of the term “expected” is not clear. It could refine `FutureEconomicBenefit` or `flow` (which is a relation). In other words, does the definition expect *flow of benefit*, or does it expect *future economic benefit*? The

¹⁰⁹ Called an “ObjectProperty” in Protégé.

modeling decision was made to associate it with economic benefit and thus an ExpectedFutureEconomicBenefit or the EFEB class was created as a subclass of FutureEconomicBenefit that is also expected by an entity.

The object properties (relationships) used in the formalisation of the asset definition are: happenIn, isResultOf, hasTypeOfControl, isControlledBy, expectedBy, fromWhichInflow.

Finally, the representation definition of an Asset is a ControlledResource and fromWhichInflow.EFEB

The following Description Logic symbols, as listed in Table 7.1, were used in the formal representation of the definitions:

Table 7.1: Description Logic symbols

Symbol	Meaning
\sqcap	Intersection or disjunction, the overlap between sets. If S and T are sets of formula, $S \sqcap T$ is a set containing those elements that are members of both.
\sqcup	Union or conjunction used to join sets. If S and T are sets of formula, $S \sqcup T$ is a set containing all members of both S and T.
\sqsubseteq	A subset containing some or all elements of another set. $A \sqsubseteq B$ means A is_a B or A is_a type of B.
\neg	Negation, is not. $\neg A$ means not A.
\equiv	If and only if, is defined as.
\forall	For all. Universal quantifier. $\forall r.E$ means r for-all E.
\exists	Existential quantification, exist some.

A formal representation of the definition for asset is provided in Figure 7.7.

<pre> PastEvent \sqsubseteq Event \sqcap \exists happenIn.Past Control \sqsubseteq \exists isResultOf.PastEvent Entity \sqsubseteq \exists hasTypeOfControl.Control ControlledResource \sqsubseteq Resource \sqcap \exists isControlledBy.Control EconomicBenefit \sqsubseteq Benefit FutureEconomicBenefit \sqsubseteq EconomicBenefit \sqcap \exists happenIn.Future EFEB \sqsubseteq FutureEconomicBenefit \sqcap \exists expectedBy.Entity Asset \equiv ControlledResource \sqcap \exists fromWhichInflow.EFEB </pre>

Figure 7.7: Formal representation of Asset

7.3.3 Modeling the Definition for Liability

The definition for liability according to the CFFR (IASB, 2010a:4.4 (b)) is formulated as:

“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.”

Obligation and Settlement were identified as two additional disjoint classes added to the classes identified in the definition for Asset, to formalise the definition of Liability. According to the definition, a present obligation is settled by the outflow of resources embodying economic benefits. The description “resources embodying economic benefits” implies an additional class, thus the class `ResourcesEmbodyingEconomicBenefits` were created to be able to stick to the wording of the official definition of Liability.

The class `ResourcesEmbodyingEconomicBenefits` caused a modeling problem in Protégé as the class `Resource` embodies all the resources available in reality. During the modeling of the definition of Asset, the class `Resource` was refined within the financial reporting domain so that only those resources that are under the control of a reporting entity can be classified as an `Asset`. The implication is that only the class `Asset` can embody an outflow of economic benefit from a reporting entity to settle a present obligation. A `Resource` that does not comply with the definition of an asset cannot be used to settle a liability of a reporting entity. This is an example of domain knowledge implied in one of the most basic definitions used in financial reporting. The definition of liability should be integrated with the definition of asset. See

Figure 7.8 for a schematic presentation of the relationship between `Resource` and `Asset`.

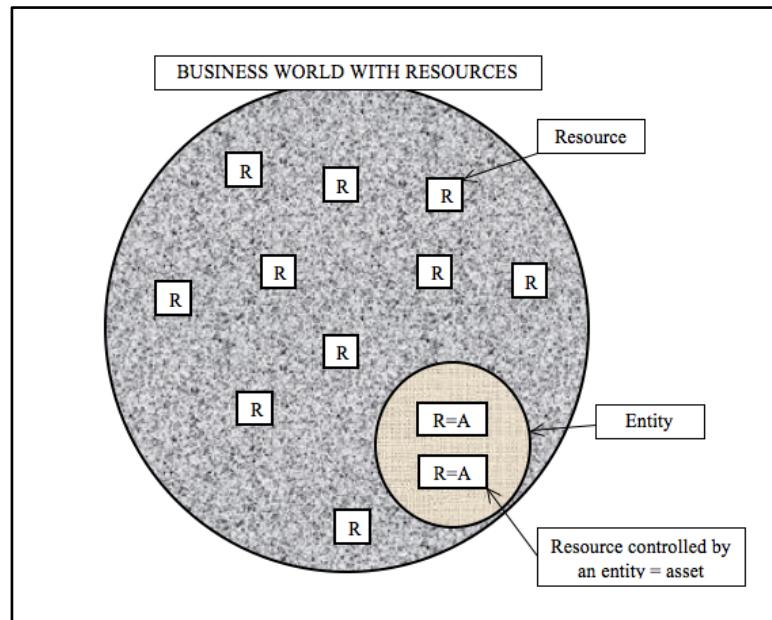


Figure 7.8: Relationship between `Resource` and `Asset`

The use and meaning of `expected` is problematic as it is not clear whether `expected` refines `Settlement` or `flow` (which is a relation). Does the

definition expect the flow or expect the resulted settlement? A modeling decision was made to create an `ExpectedSettlement` class as a `Settlement` that `isExpectedBy` some `Entity`.

The object properties (relationships) used in the formalisation of the liability definition are: `hasSettlement`, `isResultOf`, `happenIn`, `hasObligation`, `embodies`, `fromWhichOutflow`.

A formal representation of the definition for liability is provided in Figure 7.9.

```

Obligation ⊆ ∃ hasSettlement.Settlement ⊓ ∃ isResultOf.PastEvent
PresentObligation ⊆ Obligation ⊆ ∃ happenIn.Present
Entity ⊆ ∃ hasObligation.Obligation
ControlledResource ⊆ Resource ⊓ ∃ isControlledBy.Control

ResourceEmbodyingEconomicBenefit ⊆ Resource ⊓ ∃
embodies.EconomicBenefit
Settlement ⊆ ∃ fromWhichOutflow.ResourceEmbodyingEconomicBenefit
ExpectedSettlement ⊆ Settlement ⊓ ∃ expectedBy.Entity

Liability ≡ PresentObligation ⊓ ∃hasSettlement.ExpectedSettlement
  
```

Figure 7.9: Formal representation of liability

7.3.4 Modeling the Definition for Equity

The definition for equity according to the CFFR (IASB, 2010a:4.4 (c)) is formulated as:

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

In analysing this definition, `Interest` was identified as an additional and disjoint class to be used for equity. `ResidualInterest` is a type of `Interest` that has to be refined further as it is *interest* in assets *after deducting* liabilities. One way to formalise the notion of deduction in a DL ontology is through set difference or formally: $B \setminus A = \{x \in B \mid x \notin A\}$ ³. For the equity definition, it is viable to use set difference and therefore `Equity` was initially modelled as `Asset` and **not** `Liability`.

However, this definition of `Equity` resulted in an inconsistency in Protégé. The reasoner inferred that the `Equity` and therefore `Asset` classes are inconsistent (or sub-classes of `Nothing`) as indicated in Figure 7.10.

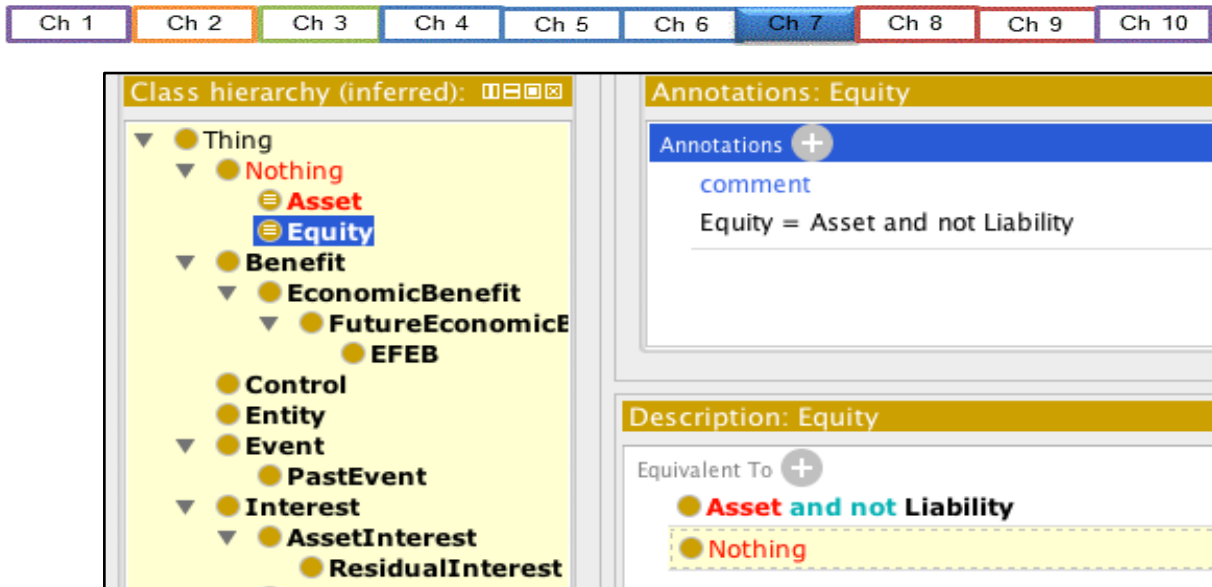


Figure 7.10: Inconsistency in equity definition

The definition of equity is inconsistent because, from the previous definitions, an Asset is a refined **Resource** and a Liability is a refined **obligation**. An Asset and an Obligation are derived from different and disjoint classes and therefore no class can be created that is a combination of them, in this case deducting Liability from Asset.

A semantic analysis using implicit domain knowledge was performed on the definition of equity in order to try to remove the inconsistency. The origin of the current definition of equity can be traced back to the formulation of the accounting equation by Hugh Oldcastel in 1543 (see section 2.3.2a) (Edwards, 1960; Fogo, 1905) resembling more of a calculation than a definition. Based on the accounting equation by Hugh Oldcastle, the definition of equity implies a *value*, or in the terminology of the definition, an *interest* to be associated with both assets and liabilities because *residual interest* is the result.

The inconsistency in the text is caused by the implicit assumption that asset and liability have associated values, which also implies that equity must have a value, even though this implied value is never stated in the text. The definitions do not provide any guidance on how the values should be determined. Using domain knowledge of accounting and financial reports, the assumption is made that the total value of assets less the total value of liabilities results in the total value of equity.

A modeling decision was made to add AssetInterest and LiabilityInterest as types of Interest specifically to be able to indicate that Asset and Liability hasInterest some AssetInterest and LiabilityInterest respectively as indicated in Figure 7.11.

Furthermore, using set difference for deduction in this ontology:

- ResidualInterest is the set difference between Interest and LiabilityInterest.

- Another decision necessary here in order to model the set difference properly is that all Interest is either AssetInterest or LiabilityInterest.
- The object property used in the formalisation of the equity definition is hasInterest.
- During the first Iteration of the ontology, the formal definition of equity was formalised as: Equity is Interest and not LiabilityInterest.

A formal representation of the definition for equity is provided in Figure 7.11.

```

ResidualInterst ⊆ Interest
AssetInterest ⊆ Interest
LiabilityInterest ⊆ Interest
Interest ⊆ AssetInterest ∪ LiabilityInterest
Asset ⊆ ∃ hasInterest AssetInterest
Liability ⊆ ∃ hasInterest LiabilityInterest

ResidualInterest ⊆ Interest ∩ ¬ LiabilityInterest
Entity ≡ ResidualInterest
    
```

Figure 7.11: Formal representation of equity

7.3.5 Knowledge Contribution: Iteration 1

During Iteration 1, the notion of time and the definitions for asset, liability and equity were analysed. During the modeling process, unintended meanings and logical inconsistencies were indicated. It was determined that it is possible to formalise the definitions after some modeling decisions were made. Iteration 1 is the first model output of DSR Cycle 4 and the second knowledge contribution point in the FEDS Technical Risk & Efficacy evaluation strategy towards building the CFfFR ontology. Iteration 1 moved towards the naturalistic and summative axis on the FEDS evaluation strategy with the formalisation of time and proposal of the definitions for the SFP elements as illustrated in Figure 7.12.

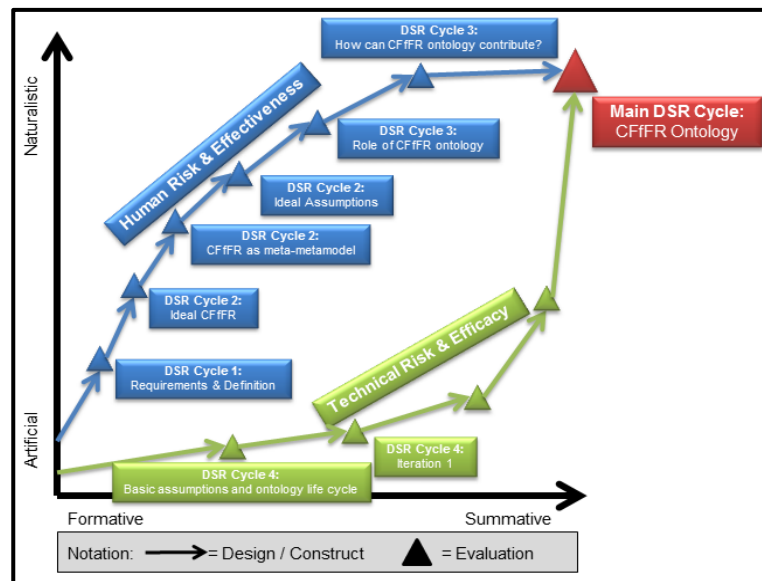


Figure 7.12: FEDS Strategy - DSR Cycle 4, Iteration 1

7.4 Building the Ontology: Version 1 - Iteration 2

The formal representations developed during Iteration 1 were used as basis to refine the formalisations during Iteration 2. During Iteration 1, the definitions were formalised using only the written text of the actual definitions. During Iteration 2, the wider context of the CFfFR was considered to determine if there is additional information provided in the CFfFR to clarify some of the problems experienced during Iteration 1.

During the time when the work was done on the second Iteration, a review of the CFfFR was published by the IASB as DP/2013/1 (IASB, 2013a). As the IASB made some suggestions regarding the formulation of the definitions for asset, liability and equity in DP/2013/1 those suggestions were taken into consideration when the formalisations were refined. In order to test if it is possible to formulate logically consistent and clear definitions for asset, liability and equity definitions for these, elements were modelled taking into account information provided in DP/2013/1 and using Protégé.

The first step was to identify the most basic classes and relationships related to the elements of the SFP.¹¹⁰

7.4.1 Identification of Basic Classes and Relationships

For the purpose of the second Iteration of the ontology, the **most basic classes** represented in the elements of the SFP were identified. According to the analysis of the CFfFR and the current definitions of the elements of the SFP, the most basic classes contained in them are **resources**, **claims** (against those resources) and **entity** (the owner of the resources and claims) (IASB, 2010a:OB12). In the CFfFR of the IASB (2010a:OB12) it is stated that a financial report contains information about claims and economic resources. Equity and other obligations are therefore claims against the reporting entity, and resources under its control constitute the assets.

These classes must be disjointed from each other as specified during Iteration 1. Within ontology engineering, the identification of the class hierarchy is a departure point. The class hierarchy (or taxonomy) is the logical relationship between **sub-classes** (lower on the hierarchy of concepts) to the most basic classes or **top-level classes**.

No sub-classes were identified under the class `Resource`, whilst two sub-classes were identified under `Claims`, i.e. `Equity` and `Liability`. The next decision was to determine the most basic distinguishing aspect between `Equity` and `Liability`. According to a reading of the comments in DP/2013/1, the most distinguishing aspect is the class `Obligation` as defined and explained in the DP/2013/1 on the reporting date / `ConsiderationDate` (section 7.2.3). The time notion *present* (`ConsiderationDate`) functions as a deciding factor to determine an obligation on the reporting date. `Equity` is linked to `Entity` with the object property `isOwedBy`,

¹¹⁰ The work done in Iteration 2 was partially reported on in (Gerber, Gerber, Van der Merwe, et al., 2015).

but it is not an Obligation on the ConsiderationDate (distinguished from liability by the temporal class TemporalInstant sub-class ConsiderationDate).

Another distinguishing aspect is that Equity is always linked to at least one Shareholder (or owner). Equity is always owed to a shareholder and it cannot be owed to a class other than a shareholder. Shareholder serves as a second class to distinguish Equity from Liability. Both conditions (no-obligation and Shareholder) must be valid in order for something to be classified as equity. Equity is a Claim with no Obligation owed to a Shareholder on ConsiderationDate.

Once Equity was distinguished from Liability by the classes Obligation, and Shareholder two sub-classes of liability were identified. A distinguishing aspect of an obligation according to the discussion in DP/2013/1 is: *How will the obligation be settled?* The two most basic ways in which an obligation may be settled is either by providing equity or by parting control of a resource (asset or by delivering a service). If equity becomes an obligation, it changes to be a liability although it is still owed to a shareholder as one of the classes, no-obligation, is not valid any more. For practical purposes of this study, it is then called an “equity” liability. Even when an obligation is partially settled by equity and partially by an asset (hybrid instrument), it only represents a combination of the two most basic settlement methods.

The basic classes and relationships are schematically presented in Figure 7.13.

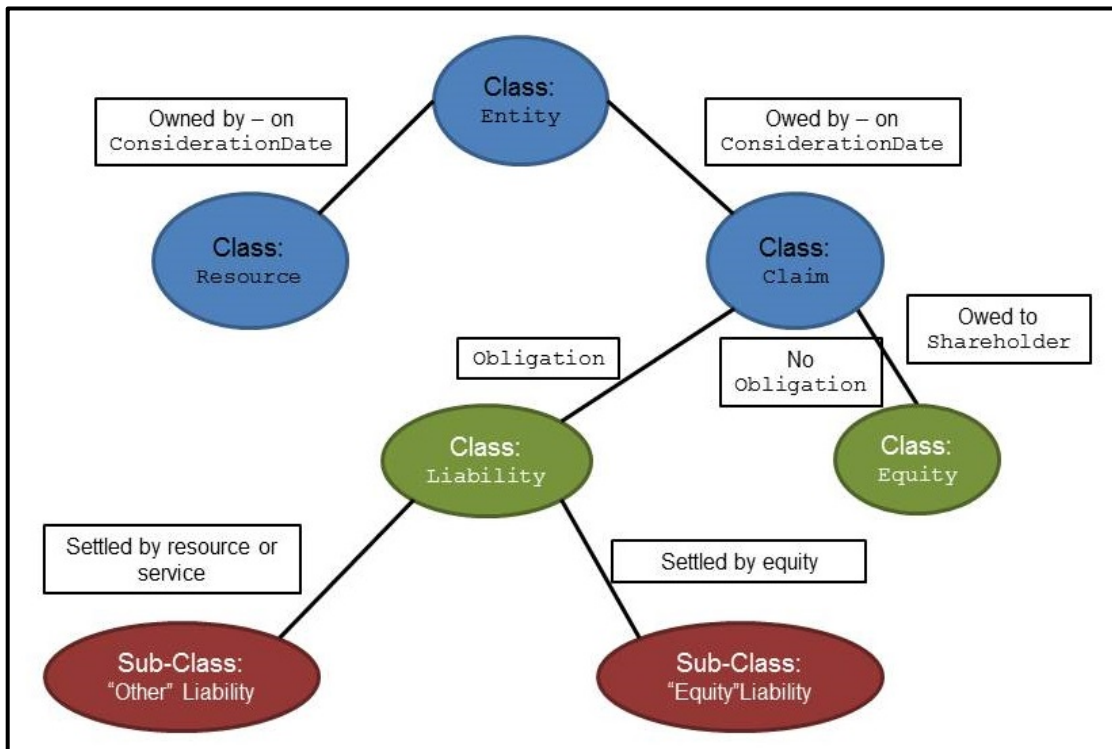


Figure 7.13: Basic classes and relationships of the SFP elements

With the most basic classes and relationships of the elements representing financial position identified, it was attempted to formalise the definitions of these elements using the additional information obtained from DP/2013/1 (IASB, 2013a).

7.4.2 Modeling the Definition for Asset

a) *DP/2013/1 asset definition*

In DP/2013/1 (IASB, 2013b) an asset of a reporting entity is defined as: “*a present economic resource controlled by the entity as a result of past events*”. In addition to the asset definition an economic resource is defined as: “*a right, or other source of value, that is capable of producing economic benefits*” (IASB, 2013b).

The asset definition as stated in DP/2013/1 addresses the following questions raised on the definition in the CFfFR (section 7.3.1):

1. A “resource” is defined as “a right, or other source of value”. This provides some clarity, but from a logical modeling perspective, the definition “resource” is in the first instance “a source of value” of which a “right”¹¹¹ is one type of source of value. The implication is that there are also “sources of value” other than rights that are resources. It is open for interpretation to determine what the “other sources of value” may be.
2. The sub-class `EconomicBenefit` is still used in the definition of economic resource.
3. As the words “controlled by”, is still used in the same manner in the definition in DP/2013/1 as in the CFfFR (section 7.3.1) the same ambiguity exists in SP/2013/1.
4. DP/2013/1 excludes the term “expected”, which solves the problems experienced with the representation of the CFfFR definition. There is however still some uncertainty built into the term “capable” as it is used in the definition, which should provide for some uncertainty.
5. Regarding the use of time “present”: As acknowledged by the IASB (IASB, 2013b) par. 2.16 (b) “this notion is already implicit in the existing definition” and by making it explicit does not contribute to make the definition more clear, in fact it created some problems. To include “present” in the definition on the basis of “emphasising the parallel with the definition of a liability” (IASB, 2013b:para. 2.16 (b)) is not enough motivation to include it in the definition of an asset. When attempting to represent “present economic resource” it was unclear what “present” means? Is it the resource that has economic value at “present”, or is it a “present” resource? What does the time notion “present” refer to, is it for example the reporting date or the time of consideration? If “present” refers to the reporting date, it is assumed and not clear from the text.

¹¹¹ See the DP/2013/1 (IASB, 2013b) par 2.14 (a) for an example of a “right”.

b) Proposed asset definition

Part of the study was to determine if it is possible to formally represent the definitions of the elements providing the financial position of a reporting entity in a logically consistent and clear manner.

The following serves as motivation for the proposed asset definition:

1. The proposed definition includes the additional definition provided in the DP/2013/1 for economic resource. The combination of the two definitions helps to eliminate possible ambiguities and vagueness.
2. The sub-class `EconomicBenefit` was kept, as it is a deciding class in the process to determine an asset. The remarks regarding the clarity of the meaning of “economic” are maintained.
3. Based on the discussion above the notion of time “present” was omitted in the proposed definition.
4. It was decided not to dissect the proposed definition of control as provided in DP/2013/1 (IASB, 2013b:para. 3.23), however some possible issues in the proposed definition were identified namely:
 - a) The intended meaning of “presentability”;
 - b) The intended meaning of “that flow from it”; and
 - c) The previous comments on “economic”, “present” and “benefit” that are also applicable to the proposed definition of control.

Based on the problems identified in section 7.3.1 and the definition provided in DP/2013/1, the following definition for asset is proposed and then formalised:

An asset of a reporting entity is: *a resource (right or other source of value), which is under the control of an entity as a result of past events and which is capable of producing economic benefits.*

In order to formally represent the proposed asset definition the following additional classes were created: `SourceOfValue`, `OtherSourceOfValue`, `Right`.

The object properties (relationships) used in the formalisation of the liability definition are: `isCapableToProduce`, `isUnderControlOf`, `isControlOf`, `isResultOf`.

The following is a formal representation of the proposed asset definition:

```

Asset ≡ Resource ⊓ ∃ isCapableToProduce.EconomicBenefit ⊓ ∃
isUnderControlOf.Control
Control ⊆ ∃ isControlOf.Entity ⊓ ∃ isResultOf.PastEvent
Resource ≡ SourceOfValue ≡ OtherSourceOfValue ⊔ Right
OtherSourceOfValue ⊆ ¬ Right
EconomicBenefit ⊆ Benefit
PastEvent ⊆ Event ⊓ ∃ happenIn.Past
Past ⊆ Interval ⊓ ∃ temporalEnds.{ConsiderationDate}
  
```

Figure 7.14: Proposed asset definition

The proposed definition is logically consistent according to the DL used in Protégé.

7.4.3 Modeling the Definition for Liability

a) *DP/2013/1 liability definition*

In DP/2013/1 (IASB, 2013b) a liability of a reporting entity is defined as: “*a present obligation of the entity to transfer an economic resource as a result of past events*” (IASB, 2013b).

When attempting to model *liability* as proposed in the DP/2013/1, the following was found:

1. A reporting entity can only transfer economic resources under control of that specific reporting entity and not any economic resource. See the comments made under the discussion of the CFfFR liability definition (section 7.3.3).
2. The problem regarding “expected” identified in CFfFR definition is solved with the exclusion of “expected” from the DP/2013/1 liability definition.
3. The discussion on the use of the time notion “present” in the definition of an asset is also valid in the use of the time notion “present” in the liability definition.
4. In the DP/2013/1 (IASB 2013, par. 2.16 (a)) it is emphasised that “present” / (*ConsiderationDate*) contributes to decide whether a liability exists at the reporting date. This corresponds with the discussion on the identification of the basic classes and relationships in section 7.4.1.

b) *Proposed liability definition*

The following is suggested to be able to formally represent the definition of liability in an unambiguous way:

1. The words “of the entity” in the definition in the DP/2013/1 be replaced with “owed by the entity”. The purpose of the change is to emphasise and clearly formulate the relationship between the classes *Obligation* and *Entity*.
2. Replace “present” with “time of consideration” (*ConsiderationDate*) as it will clearly indicate the intended meaning of present.
3. The phrase “transfer an economic resource” is not included in the proposed definition because of the problem discussed above. The reason is not to have an inconsistency with the proposed definition of equity.
4. In order to reflect the basic classes and relationships identified and reported on in section 7.4.1 (Figure 7.13) it is suggested that obligations should differentiate between “obligations to transfer an asset” and “obligations to transfer equity”.
5. From the perspective of a liability, the only distinguishing factor between a liability and equity will be if a claim is an obligation at the date of consideration or not.

Based on the problems identified in section 7.3.3 and the definition provided in DP/2013/1, the following definition for liability is proposed and then formalised:

A liability is: “An obligation, owed on the time of consideration by the reporting entity as a result of past events”.

The object properties (relationships) used in the formalisation of the liability definition are: *isOwedBy*, *isResultOf*, *isControlOf*, *isValidInTime*.

Figure 7.15 is a formal representation of the proposed liability definition.

```

Liability ≡ Obligation ∧ ∃ isOwedBy.Entity
          ∧ ∃ isresultOf.PastEvent ∧ ∃ isValidInTime.TimeOfConsideration
Obligation ≡ PresentObligation ≡ ⊆ ∃
          isValidInTime.TimeOfConsideration
Obligation ⊆ Claim ∧ ∃ isresultOf.PastEvent
Liability ⊆ ¬ Equity
    
```

Figure 7.15: Proposed liability definition

The proposed asset and liability definitions are logically consistent and internally coherent.

7.4.4 Modeling the Definition for Equity

a) DP/2013/1 equity definition

No changes to the equity definition is proposed in DP/2013/1. The inconsistency in the current definition for equity detected in Iteration 1 and reported on in section 7.3.4 (Figure 7.10) is still valid.

b) Proposed equity definition

The analysis of the basic classes and relationships (section 7.4.1) serves as basis for the proposed equity definition. The two deciding factors that must both be valid to distinguish equity and liability were identified as No-Obligation and Shareholder (section 7.3.4).

The following definition for equity is proposed: “Equity is a shareholder claim against a reporting entity that is the result of a past event and which is not an obligation on the consideration date”.

In order to formally represent the proposed equity definition, the following additional class was created: Shareholder.

The object properties (relationships) used in the formalisation of the equity definition are: isOwedBy, isResultOf, isClaimOf.

A formal representation of the proposed definition for equity is provided in Figure 7.16.

```

Equity ≡ Claim ∧ ¬ PresentObligation ∧ ∃ isClaimOfShareholder
          ∧ ∃ isOwedBy.Entity ∧ ∃ isResultOf.pastEvent

Equity ⊆ ¬ Obligation
    
```

Figure 7.16: Proposed equity definition

The proposed equity definition can be formally represented and is not inconsistent with the liability definition. The definition corresponds with the most basic classes and relationships identified in section 7.4.1.

The following table summarises the three definitions of *asset*, *liability*, *equity* and *economic resource* from the different sources in this study.¹¹²

Table 7.2: Summary of SFP definitions

Definition	CFfFR	Discussion Paper DP/2013/1	Proposed
Asset:	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	A present economic resource controlled by the entity as a result of past events.	A resource (right or other source of value) which is under the control of an entity as a result of past events and that is capable of producing economic benefits.
Liability:	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.	A present obligation of the entity to transfer an economic resource as a result of past events.	An obligation, owed on the time of consideration by the entity as a result of past events.
Equity:	Equity is the residual interest in the assets of the entity after deducting all its liabilities.	Equity is the residual interest in the assets of the entity after deducting all its liabilities.	A shareholder claim against the entity, that is the result of past events and which is not an obligation on the time of consideration.
Economic resource	No existing definition	A right or other source of value, that is capable of producing economic benefits.	Incorporated into the definitions.

During the second Iteration of the ontology building process it was determined that by making certain modeling decisions it is possible to build an ontology of the definitions of the elements for financial position that is logically consistent and internally coherent. With this knowledge, it was attempted in Iteration 3 to build an ontology of the CFfFR.

7.4.5 Knowledge Contribution: Iteration 2

During Iteration 2, the knowledge obtained in Iteration 1 was used to formulate and model the definitions of the elements of the SFP. Additional information was obtained from DP/2013/1¹¹³ to assist with the modeling process, as DP/2013/1 addressed some of the unintended meanings identified during Iteration 1. Iteration 2 is the second model output of DSR Cycle 4 and the third verification point in the FEDS Technical Risk & Efficacy evaluation strategy towards building the CFfFR ontology.

¹¹² Also reported in (Gerber, Gerber, Van der Merwe, et al., 2015).

¹¹³ At the time Iteration 2 was modeled, the ED on the CFfFR (IASB, 2015d) was not available. For the purpose of the study, this use of DP/2013/1 is sufficient to indicate how to build a CFfFR ontology in order to answer the main research question.

Iteration 2 moved further towards the naturalistic and summative axis on the FEDS evaluation strategy, as the iteration is more technical and building on previous knowledge.

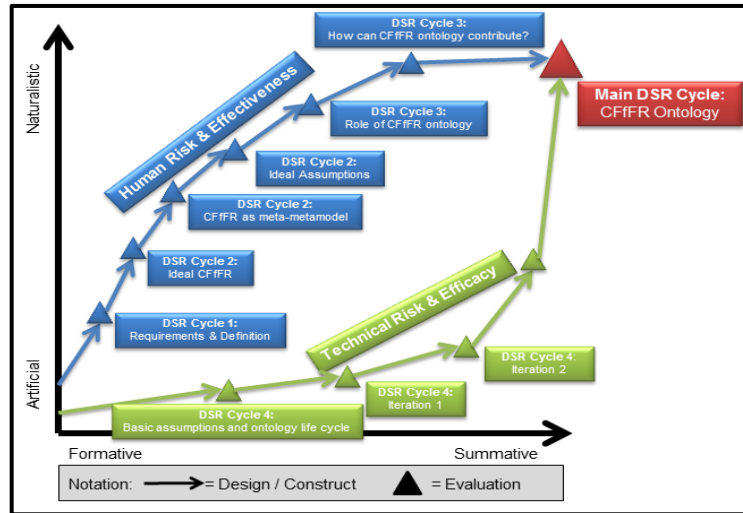


Figure 7.17: FEDS Strategy - DSR Cycle 4, Iteration 2.

7.5 Building the Ontology: Version 1 - Iteration 3

Based on the analysis of the basic classes and relationships and the formal representation of the definitions of the elements for the financial position (section 7.3.5) of a reporting entity, the first attempt was made to build an ontology of the complete CFfFR in Iteration 3.

During Iteration 3, the goal was to understand the role, position, content and usage of the CFfFR and how an ontology could fulfil the intended purpose and objective of the CFfFR. The theoretical background that serves as basis for Iteration 3 is the result of Chapters 5 and 6. In Chapter 5, it was determined that the CFfFR can be viewed as a meta-metamodel serving as a truth container for the financial reporting domain (section 5.2.3). In Chapter 6, it was established that the CFfFR ontology could serve as a formal domain ontology for financial reporting (section 6.4). If the CFfFR is viewed as a truth container and if the CFfFR ontology serves as a formal domain ontology for financial reporting, then the CFfFR ontology should contribute towards the intended purpose and objective of the CFfFR.

The intended purpose of the CFfFR is to provide accounting standard setters with a coherent framework for setting standards and to help preparers and users of financial reports to understand the postulates and principles behind accounting standards (section 4.4.2). The objective of the CFfFR follows a decision-useful approach providing the criteria to be used when deciding when information is useful for users and should be included in a financial report (section 4.5.1c).

7.5.1 Identifying Key Classes and Relationships for the CFfFR Ontology

Following the OLC Model Phase 2 (section 7.2.2a) of Neuhaus et al. (2013) the natural text of the CFfFR (IASB, 2010a) was analysed with the purpose to determine

key classes and relationships for the CFfFR ontology. The analysis (refined and completed during Iteration 4) is provided in Appendix D – CFfFR working document) and Appendix E – Ontology engineering decisions).

The key classes and relationships were formalised in a first version of a CFfFR ontology. During the first version ontology of the CFfFR, DOLCE was selected (Guarino, 2015; Gangemi, Guarino, Masolo, Oltramari, & Schneider, 2002; Borgo & Masolo, 2009) as an upper ontology to provide structure to the ontology (Figure 6.6). Within the DOLCE upper ontology the following classes (together with their respective sub-classes) were identified as non-physical-endurant under the sub-class non-physical-object category.¹¹⁴

Table 7.3: Non-physical endurant classes

Class	Annotation
Action	The class <i>Action</i> refers to the decisions of users who should take action based on information provided in a financial report. The actions can be buying, selling, holding or lending (IASB, 2010a:OB3).
Benefit	Three types (sub-classes) of benefits are mentioned in the CFfFR. Benefit is related to (1) users that should benefit from information, (2) benefit in relationship to cost of information and (3) an economic benefit for a reporting entity.
Capital	In the CFfFR, the capital concept is prominent and represents invested money and is used as synonymous with net assets or equity (IASB, 2010a:4.57).
Claim	<i>Claim</i> was identified in section 7.4.1 as one of the two most basic classes providing the financial position of a reporting entity.
Control	<i>Control</i> results in ownership over a resource.
Decision	<i>Decision</i> is a type of action.
Element	<i>Element</i> is a part of a statement. <i>Element</i> is not defined in the CFfFR. Asset, liability, and equity are referred to as elements providing the financial position of a reporting entity. Income and expense are referred to as elements portraying the performance of a reporting entity.
Entity	A modeling decision was made to assume that <i>Entity</i> refers to the Entity that is reporting on relevant economic activities i.e. the reporting entity. <i>Entity</i> is not defined in the CFfFR.
Information	The provision of information to users of financial reports is the aim of financial reporting. This is a very vague concept at present but it is mentioned prominently within the CFfFR.
Instrument	In the financial reporting domain, <i>Instrument</i> is linked to economic ideas for example debt and equity.
Management	According to footnote 2 on paragraph OB2 of the CFfFR, <i>Management</i> refers to management and the governing board of an entity. No further distinction is made in the CFfFR regarding management.
Responsibility	<i>Responsibility</i> is linked to management.
Settlement	<i>Settlement</i> is the terminology used to describe the repayment of a debt.
Statement	The class <i>Statement</i> is reserved in the ontology to refer to a financial statement. Four types of financial statements are mentioned in the CFfFR, Statement of Financial Position, Statement of Profit or Loss and Other Comprehensive Income, Statement of Changes in Equity and Statement of Cash Flows. A financial statement is defined as forming part of a Financial Report, with Financial Report representing the bigger collection.
Value	To be reported in a financial report and more specifically in a financial statement, an economic activity should pass through the decision filter

¹¹⁴ For an explanation on the meaning and use of endurants and perdurants see (Borgo & Masolo, 2009; Schneider, 2010; Guizzardi & Halpin, 2008; Guizzardi, 2005).

Class	Annotation
	(Figure 7.19) and during the decision process a monetary value should be allocated to a specific economic activity before it can be reported. In essence, it is values of economic activities that are reported and not elements.

The following classes (together with their respective sub-classes) were classified under the *physical-endurant, physical-object* category:

Table 7.4: Physical endurant classes

Class	Meaning
Report	Even though the classes “financial statement” and “financial report” are used as synonyms in the CFfFR, there are distinct differences. Financial statements can exist separate from a financial report. A financial report always contains a set of financial statements, so the <i>PartOf</i> relationship holds. The <i>FinancialReportDate</i> is the present reporting date, which is the end date of the past reporting period. This is the date printed on the title of the financial report. The information regarding the <i>FinancialReportDate</i> was obtained from an example of a financial report and does not originate from the CFfFR.
Statement	The class <i>Statement</i> is reserved in the ontology to refer to a financial statement. Four types of financial statements are mentioned in the CFfFR, Statement of Financial Position, Statement of Profit or Loss and Other Comprehensive Income, Statement of Changes in Equity and Statement of Cash Flows. A financial statement is defined as forming part of a Financial Report, with Financial Report representing the bigger collection.
Resource	The meaning of the class <i>Resource</i> was discussed in detail in section 7.4.1.
User	The class <i>User</i> is refined with some sub-classes such as external users of financial reports such as investors, shareholder and lenders. There are also users of the CFfFR such as standard setters, preparers of financial reports, auditors and academics.

The first version of the CFfFR ontology was an attempt to formally represent all the classes included in the decision process model.

The following class (together with their respective sub-classes) in Table 7.5 was classified under the *perdurant / event / accomplishment* category:

Table 7.5: Perdurant, event, accomplishment

Class	Meaning
Event	Event is classified as a <i>perdurant accomplishment</i> and then further refined as a <i>FinancialActivityEvent</i> . A <i>PastEvent</i> was identified as one type of <i>FinancialActivityEvent</i> .

The *TemporalClass* class was formalised and discussed during Iteration 1 and 2 when the definitions of the elements providing the financial position were formalised (section 7.2.3).

The first version indicating the *is_a* relationships of the CFfFR ontology is provided in Figure 7.18.¹¹⁵

¹¹⁵ The first version of the CFfFR ontology was published in (Gerber, Gerber, & Van der Merwe, 2015).

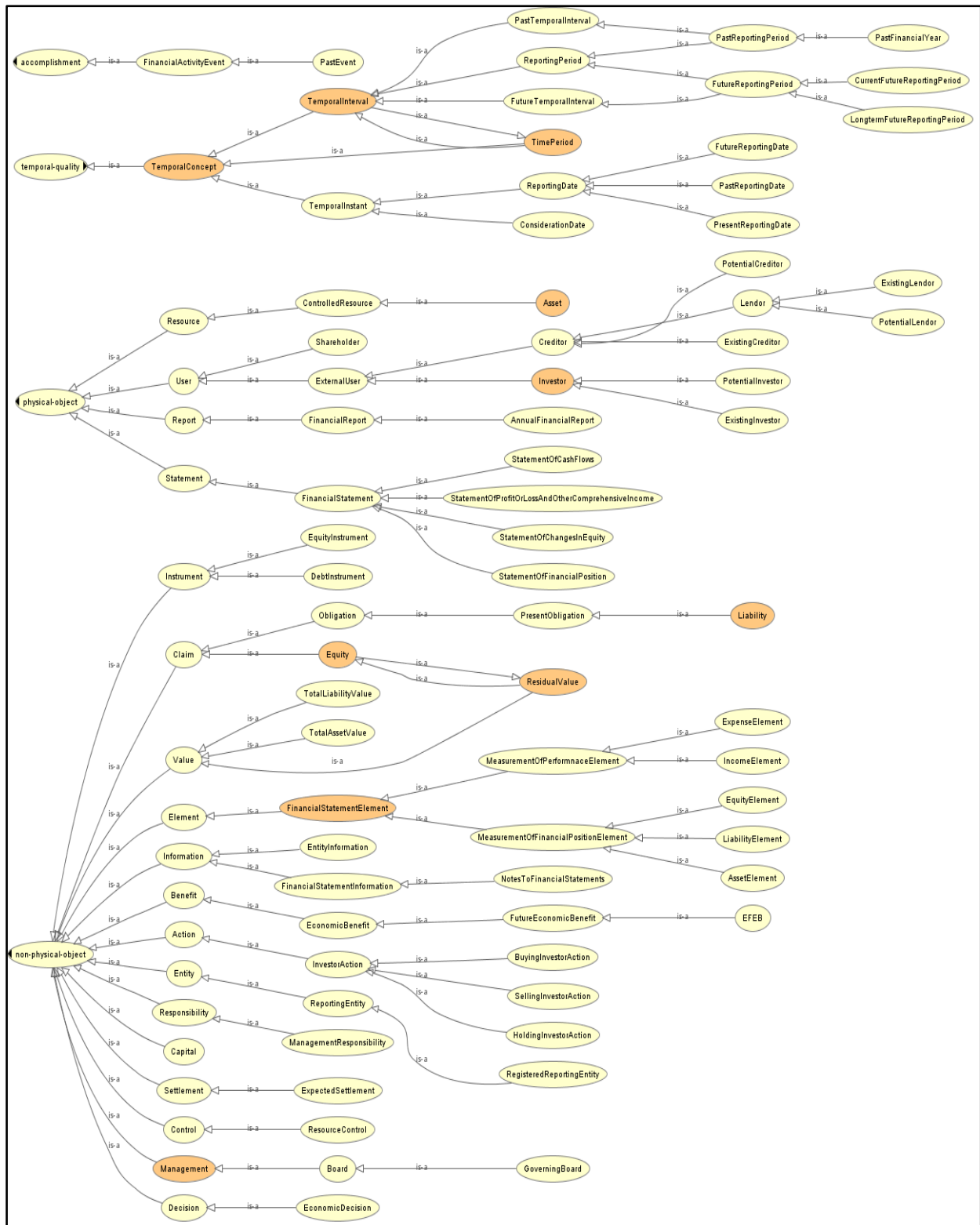


Figure 7.18: CffFR ontology first version: is_a relationships

During the Analysis Phase it was determined that some information guiding the decision process to determine and report decision-useful information in financial reports is lacking. Significant challenges were experienced to identify the key classes and relationships and construct precise ontological assertions. It was determined that

significant, implicit and common domain knowledge is required to understand and interpret the CffFR, IFRS's and financial reports. Although, within the financial reporting domain, the decision process is regarded as implicit knowledge (common knowledge), it is critical to make this knowledge explicit for the CffFR ontology construction.

In order to comply with the most basic objective of the CffFR, to provide the postulates and principles that would provide decision-useful information to users of financial reports, it was determined that the CffFR on its own does not contain enough detail to construct precise ontology assertions. Since the scope of the CffFR is financial reporting, example financial reports were included in the process (using a bottom-up approach) to assist with identifying key classes to be formalised. The ontology was changed to include the classes

```
AnnualFinancialReport, StatementOfCashFlows,
StatementOfChangesInEquity, StatementOfFinancialposition,
StatementOfProfitOrLossAndOtherComprehensiveIncome,
FinancialStatementInformation, NotesToFinancialStatements.
```

These classes are the physical objects on which the decision-useful information are published and should be part of the CffFR ontology if the CffFR ontology must contain the basic classes related to the provision of decision-useful financial information. Although the use of these classes is implied domain knowledge, it is essential that it is included in the CffFR ontology.

Another class identified in the CffFR that created a challenge is the class `Element`. The CffFR mentions the elements of the statement of financial position when it refers to the classes `Asset`, `Liability` and `Equity` and the elements of financial performance when it refers to the classes `Income` and `Expense`. The use of the word `element` in connection to financial statements implies implicit domain knowledge. When the class `Element` was analysed it was unclear what `Element` refers to.

From an ontological perspective, the problem was defining what exactly an “element” is when looking at a financial statement and how it should be formalised? What is reported on a financial statement is not the physical asset or liability or equity or income or expense. It is a value attached to a certain economic activity that can be classified under a class called `Asset` or `Liability` or `Equity` or `Income` or `Expense`. Once again, this is an example of implied domain knowledge required in the formalisation process. After consulting some dictionaries it was determined that an element is an essential or characteristic part of something. Applied to financial statements, an element refers to a specific part of a financial statement for example the section of the statement of financial position dealing with reporting of the value of assets. For the purpose of building the CffFR ontology, the modeling decision was made that `Element` does not refer to the physical asset (the instant) or even the value of a specific asset, but to the part of the statement reporting the value allocated to the class that can be defined as `Asset`. This interpretation of the use of the class `Element` is equal to referring to a paragraph or chapter in a book dealing with a certain topic.

What is reported is a summation (Σ) of the *measurement* (in some cases after a complex valuation process) of all the economic activities, categorized according to element characteristics and definitions. A statement of financial position does not present the assets (the actual instances) of a reporting entity, but a sum (Σ) of the value of the assets. The challenge for this study is to formally represent the key classes and relationships supporting the publication of the values allocated to economic activities that is useful for decision-making.

7.5.2 Process to Determine Decision-useful Financial Information

Another example of implicit domain knowledge not explicitly described in the CFfFR or IFRS documents is the process that is followed to allocate values to economic activities. The decision process starts when an economic activity takes place and continues until the information related to that economic activity is classified as useful for decision-making and then reported in a financial report. The information to be reported can either include a monetary value, or not.

The CFfFR was analysed to determine how this decision process takes place and to determine the most basic classes describing the decision process. The minimum key classes (classes in Protégé) identified to support the selection of economic activities that provide decision-useful information for the users are:¹¹⁶

- Objective of financial reports (serves as competency question) (IASB, 2010d:1);
- Purpose of the CFfFR (serve as competency question) (IASB, 2010d:Introduction)
- Financial Report (used ambiguous with financial statements in the CFfFR);
- Financial Statements (specific financial statements not included in the CFfFR, included in IAS1);
- Other information and reports (not included in the CFfFR);
- Reporting date and reporting period (not included in the CFfFR);
- Notions of time period and time instance (linked to accrual accounting and reporting date, not included in the CFfFR);
- Users of financial reports and the CFfFR (IASB, 2010d:1 and Introduction);
- Reporting entity (RE) (in process of development);
- Economic activity (EA) (not explicitly defined in the CFfFR);
- Going concern (IASB, 2010d:4.1);
- Accrual accounting (IASB, 2010d:OB17);
- Definitions of the elements (under revision) (IASB, 2010d:4.1–4.33);
- Recognition criteria (IASB, 2010d:4.37–4.49);
- Measurement criteria (under revision) (IASB, 2010d:4.54–4.56);
- Qualitative characteristics of decision-useful information (IASB, 2010d:QC);
- Disclosure requirements (in process of development);
- Economic activities reported in the financial report, but not included in the financial statements (not included in the CFfFR).

¹¹⁶ These key concepts are also reported in (Gerber, Gerber, & Van der Merwe, 2015).

During the decision process some of the key concepts (ideas) in the CFfFR function as decision filters in order to determine what, when and how (section 4.6.2a) (Deegan, 2014)) an economic activity should be reported in a financial report. These decision filters are organised according to a certain order, thus the numbering in the illustration (Figure 7.19).

The decision process determined by key concepts in the CFfFR functions as follows: The economic activities of a reporting entity are screened through the decision filters starting with firstly determining if the reporting entity is a going concern (filter 1). If the entity is not a going concern the criteria regarding valuation and measurement would change. As a basis for accounting the accrual principle (accrual accounting) is adopted (Filter 1). All economic activities must pass through decision Filter 1 to be included in a financial report. Certain economic activities are reported on in the notes and other information form part of the financial report without passing through Filters 2, 3 and 4. The information regarding this information must be relevant and faithfully represented (Filter 5) to be useful for decision-making and must comply with disclosure requirements (Filter 6). Filter 5 is placed after Filter 4, as the value of an economic activity needs to be known before a decision regarding the relevance can be taken.

In order to reflect and make explicit the above mentioned assumed domain knowledge, a model for the decision process through six filters in sequential order was developed (Figure 7.19).

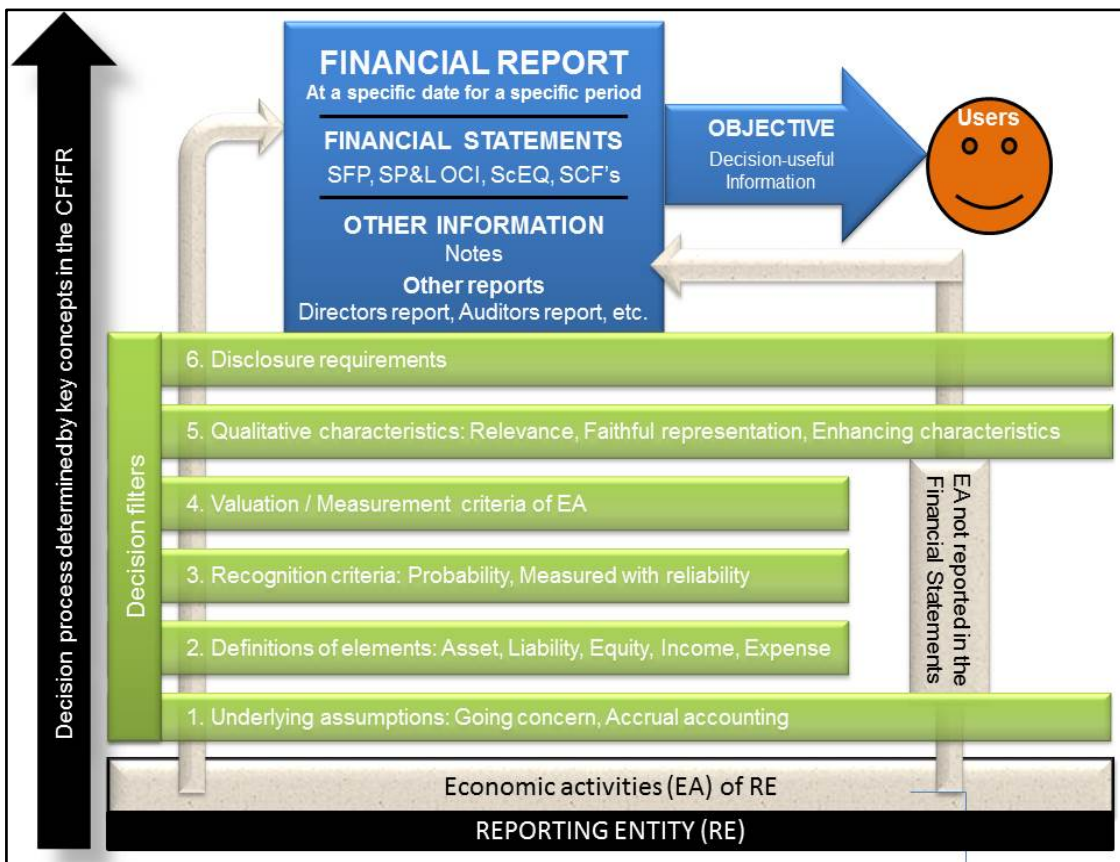


Figure 7.19: Decision process to report decision-useful information

The model was informally validated and refined using feedback from accounting domain experts. The decision filter model depicts the implicit domain knowledge regarding the transformation from economic activities of a reporting entity to the reporting of decision-useful information in a financial report. The model assisted in the identification of key classes and relationships in the first version of the CFfFR ontology.

During the process of building the first version ontology of the CFfFR it was not clear from the CFfFR what information presented in the CFfFR should be included in the ontology and what information should serve as competency questions. It was considered if the following classes, although they are present in the CFfFR, would rather contribute to the competency questions of the ontology than to the ontology itself: Action, Decision, Information, Instrument, Management, Responsibility and User. These classes were reconsidered during the fourth Iteration taking the main objective of the CFfFR ontology into account. The main objective of the CFfFR ontology was identified as to formally represent the classes and relationships in the financial reporting domain that would provide decision-useful information.

7.5.3 Knowledge Contribution: Iteration 3

During Iteration 3, the knowledge obtained in Iterations 1 and 2 was used to identify the key classes and relationships of the CFfFR ontology. The second artefact developed during Iteration 3 is the decision process model. Iteration 3 is the third model output of DSR Cycle 4 and the fourth knowledge contribution point in the FEDS Technical Risk & Efficacy evaluation strategy towards building the CFfFR ontology. Iteration 3 is more summative and more naturalistic than the previous Iterations and is the last Iteration before the CFfFR ontology was built.

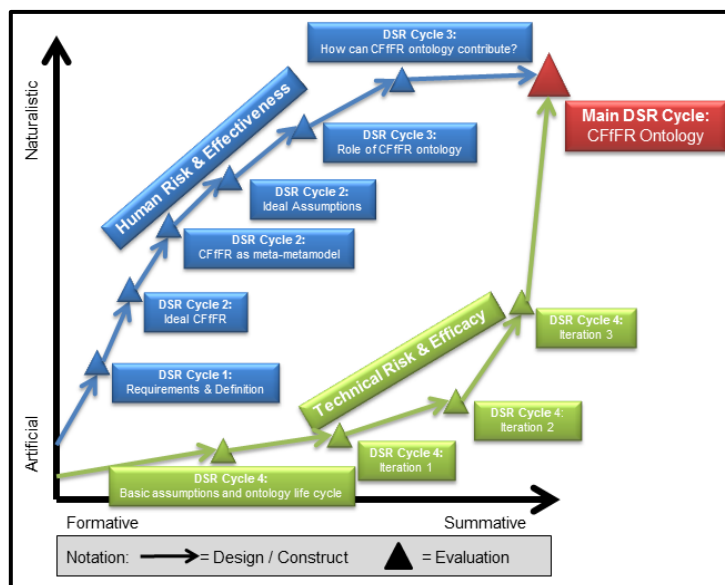


Figure 7.20: FEDS Strategy - DSR Cycle 4, Iteration 3.

7.6 Building the Ontology: Version 2 - Iteration 4

7.6.1 Reconsidering Previously Identified Classes and Relationships

The problems encountered while building the ontology of the CFfFR during Iteration 3 (section 7.5.1) and the development of the decision process (Figure 7.19) to understand how decision-useful information is selected resulted in a revision of the basic classes and relationships included in the formal representation of the CFfFR.

The CFfFR was analysed to determine what information should be included in the CFfFR ontology in order to formalise the basic classes required to provide decision-useful information. The procedure to classify and distinguish between information in the CFfFR that should form part of the CFfFR ontology and information that should form part of the competency questions informing the ontology was to read the CFfFR document paragraph by paragraph and determine where in the decision process (Figure 7.19) the information fits.

Keeping the end product, namely decision-useful information in a financial report, in mind, it was assessed if information dealt with in a paragraph would be included in a financial report or not. Information that is to be included in the financial report should be formally represented in the ontology. Information not included in a financial report either informs the ontology, thus forming part of the competency questions, or is just explanatory in nature. This classification was done to identify the classes and relationships that should be included in the CFfFR ontology in order to answer the main competency question: “*Does the CFfFR ontology formally represent the classes and relationships that would provide decision-useful information in a financial report?*” This does not imply that the other information, classified as competency questions and informative information, should be excluded from the CFfFR document as it still contains basic postulates and principles related to the financial reporting domain.

See Figure 7.21 for a schematic illustration of how the information in the CFfFR document contributes towards the CFfFR ontology.

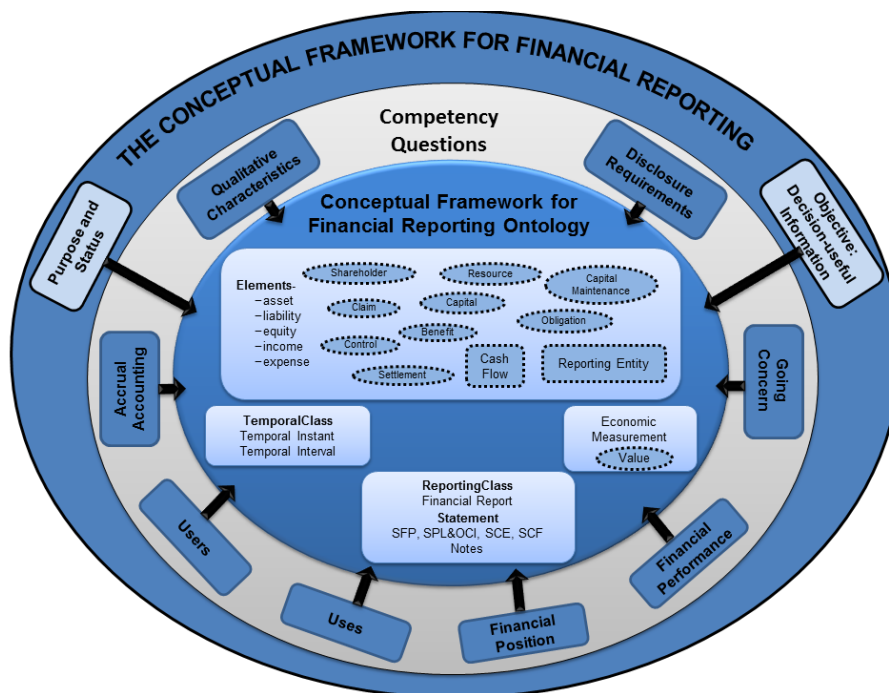


Figure 7.21: CFfFR ontology

The following classes with their respective sub-classes included in CFfFR ontology version one were reconsidered and excluded from CFfFR ontology version two: Action, Decision, Information, Instrument, Management, Responsibility and User.

Table 7.6: Classes excluded from CFfFR ontology version two

Class	Annotation in version one	Reason for exclusion from version two
Action	The class <i>Action</i> refers to the decisions of users who should take action based on information provided in a financial report. The actions can be buying, selling, holding or lending (IASB, 2010a:OB3).	Although users make decisions based on information included in a financial report, these decisions do not form part of the information in a financial report. The class <i>Action</i> was therefore excluded.
Decision	<i>Decision</i> is a type of action.	The class <i>Decision</i> as a type of action is not reported in a financial report. Decisions are made by people based on and outside a financial report.
Information	The provision of information to users of financial reports is the aim of financial reporting.	When included in version one, it was noted that the class is very vague. Although the idea (concept) of information is very prominent in the CFfFR, everything in a financial report is information. It is not possible to formally represent “everything”.
Instrument	In the financial reporting domain, <i>Instrument</i> is linked to economic ideas like debt and equity.	“Instrument” is a collective name given to certain types of financial mechanisms used by users of financial reports. The term is not used in a financial report.
Management	According to footnote 2 on paragraph OB2 of the CFfFR, <i>Management</i> refers to management and the	<i>Management</i> prepares financial reports based on the decision process indicated in Figure 7.19. The

Class	Annotation in version one	Reason for exclusion from version two
	governing board of an entity. No further distinction is made in the CFfFR regarding management.	class Management falls outside the financial report.
Responsibility	Responsibility is linked to management.	As Responsibility is linked to Management, it should also be excluded.
User	The class User is refined with some sub-classes such as external users of financial reports for example investors, shareholder and lenders. There are also users of the CFfFR such as standard setters, preparers of financial reports, auditors and academics.	The users of financial reports function outside financial reports. The needs of users inform what should be included in a financial report and can therefore not form part of the ontology.

7.6.2 Considering the Competency Questions

The CFfFR was analysed¹¹⁷ while considering the decision process (Figure 7.19) for guidance on how and what to formally represent as the classes and relationships that would answer the CFfFR ontology competency questions.

The following competency questions were formulated in section 7.2:

- (1) What are the fundamental classes and relationships of principles providing decision-useful information to the primary users of financial reports?
- (2) What are the formal definitions of the fundament classes to provide decision-useful information to the primary users of financial reports?
- (3) What is the class hierarchy of the fundament classes to provide decision-useful information to the primary users of financial reports?

The following information provides guidance to formally represent the classes and relationships:

a) Purpose and status of the CFfFR

In the purpose and status section, the scope of the CFfFR is defined. The CFfFR ontology should be designed so that it could assist the board, national standard-setting bodies, preparers of financial reports, auditors and other users of the CFfFR to understand the basic classes and relationships involved in providing decision-useful financial information.

¹¹⁷ The analysis is recorded and reported in:

Appendix A – Some major world crises in the twentieth and twenty-first centuries

A discussion of some of the major world crises in the twentieth and twenty-first centuries is included in a separate document in the CD accompanying this document.

Appendix B – Major corporate collapses

A discussion on the major corporate collapses is included in a separate document in the CD accompanying this document.

Appendix C – List of stock market crashes and bear markets

The List of stock market crashes and bear markets is included in a separate document in the CD accompanying this document.

Appendix D – CFfFR working document.

The ideal status of the CFfFR as meta-metamodel in the financial reporting hierarchy was argued in Chapter 5. The ideal role of the CFfFR ontology as a metamodel in the financial reporting ontology hierarchy was argued in Chapter 6.

b) Objective: decision-useful information

The objective of the CFfFR ontology is to formally represent the most basic classes and relationships providing decision-useful information in financial reports. This is the most basic competency question to be answered by the CFfFR ontology.

The purpose, status and objective of the CFfFR determines the broad scope of the CFfFR thus defining the broad scope of the CFfFR ontology.

Other concepts defining and informing the CFfFR ontology are:

c) Users

The users are the recipients of the financial information and the agents prescribing the information they want to be disclosed. The users cannot form part of the CFfFR ontology, they inform the CFfFR ontology.

d) Uses

There are two use categories to be considered. The first category is concerned with the discussion on the purpose of the CFfFR. These uses inform what the CFfFR should be used for and cannot be modelled. The second category of uses is concerned with the use of financial information by the users of financial reports. The second category also informs what should be included in a financial report and cannot be modelled.

e) Financial position

A financial report should provide information regarding the financial position of a reporting entity. It is a requirement that should be complied with by the CFfFR. It is complied with by modeling the definitions for and classes `Asset`, `Liability` and `Equity`.

f) Financial performance

A financial report should provide information regarding the financial performance of a reporting entity. It is a requirement that should be complied with by the CFfFR. It is complied with by modeling the definitions for and classes `Income` and `Expense`.

g) Accrual accounting

The concept accrual accounting is an underlying assumption adopted in accounting, thus forming part of decision Filter 1 (Figure 7.19). The concept of accrual accounting is adhered to by modeling the class `TemporalClass`. By formalising `TemporalInstant` and `TemporalInterval`, the principles of accrual accounting are included in the CFfFR ontology.

h) Going concern

The concept going concern is an underlying assumption informing the measurement strategy to be followed during the decision process and for that reason also forms part of decision filter one (Figure 7.19). The going concern requirement is met in the CFfFR ontology by including the class `EconomicMeasurementClass`.

i) Qualitative characteristics

The qualitative characteristics (CFfFR Chapter 3) are explicit guidelines informing when financial information should be included in a financial report. The qualitative characteristics are inherently competency questions that should be adhered to. By following the decision process (Figure 7.19), Filter 5 is the last filter in the process to decide if information is useful for decision-making and if it should be included in a financial report. A competency question of an ontology informs the ontology and is not included in the formalisation process.

j) Disclosure requirements

The last filter (Filter 6) in the decision process (Figure 7.19) determines how the decision-useful information should be disclosed in a financial report. The disclosure requirements also inform the ontology how information should be disclosed and cannot be formalised. The basic concepts for disclosure requirements have not been finalised. The IASB is working on a project to formulate the disclosure requirement concepts.

k) Incomplete aspects in the CFfFR

When the decision process (Figure 7.19) was developed and during the analysis of the CFfFR, revising version one of the CFfFR ontology, some incomplete aspects were identified in the CFfFR.

A. Reporting Entity

The starting point, or basis, of the decision process (Figure 7.19) is the reporting entity. The reporting entity as semantic domain contains everything that should be included in a financial report as the report is regarding the economic activities of the reporting entity. All the economic activities to be reported fall under the `ReportingEntity` class. The key role of the `ReportingEntity` class in the decision process stresses the importance that the concept of a Reporting Entity should be clearly described and defined.

B. Valuation / Measurement criteria

The chapter in the CFfFR dealing with measurement is out-dated and is in the process of being updated. During the revision of CFfFR ontology version one it was determined that measurement is a key concept in the translation process to attach values to economic activities. Once an economic activity has been identified to be of importance for decision-making and inclusion in a financial report, it must

be measured reliably. Based on the measurement principles, a value must be attached to the economic activity (see Filters 3 and 4 Figure 7.19). The determined value is of crucial importance for decision making by external users of financial reports. Clear and relevant measurement principles are lacking from the CFfFR. One of the biggest challenges during the development of the ontology was the measurement and translation of an economic activity in order to attach a value to the economic activity that would be useful for decision-making. The useful value should be reported in a financial report.

C. Disclosure Requirements

The last filter (Filter 6, Figure 7.19) in the decision process determines how the decision-useful information must be presented to the users of financial reports. The disclosure requirement section is still absent from the CFfFR. The IASB is in the process of developing disclosure requirement principles, but it has not been finalised and can therefore not be included in this study.

7.6.3 Building CFfFR Ontology Version 2

It was decided not to use DOLCE as upper ontology for the CFfFR ontology version two. The purpose of version two is to clearly portray four basic classes identified during the analyses of the CFfFR document to be formalised in the CFfFR ontology information. At a later stage DOLCE can be imported again.

a) *Analysis of the CFfFR to distinguish between competency questions and classes*

Figure 7.21 illustrates the composition of the concepts in the CFfFR document informing the CFfFR ontology as well as the classes to be included in the CFfFR ontology. The two outer circles inform the CFfFR ontology and the inner circle contains the four main classes identified to be formalised.

The concepts in the outer circles were discussed in section 7.6.2.

The four most basic classes identified that must be modelled to provide decision-useful information are: `EconomicMeasurementClass`, `RealityClass`, `ReportingClass` and `TemporalClass`.

b) *Economic Measurement Class*

The importance of the `EconomicMeasurementClass` was explained during the discussion of the incomplete aspects of the CFfFR (section 7.6.2k). In the CFfFR, measurement and value are concepts identified as two of the most important implied domain knowledge aspects omitted during discussions of the basic postulates and principles of financial reporting. In the discussion of CFfFR ontology version one it was mentioned that what is reported in a financial report is mostly monetary values.

For the purpose of the CFfFR ontology, it is essential that the implied domain knowledge is identified and made explicit. The class is called

the `EconomicMeasurementClass` to emphasise that it is economic values (monetary values) that are reported in financial reports. Economic values are the result of a (often-complex) measurement process, thus the use of the word *measurement*. The CffFR only talks of the reporting of assets, liabilities, equity, income and expenses without any reference to the values (economic measurement of the economic activities) attached to these classes.

In order to make this implied domain knowledge explicit, a modeling decision was made to create the following classes: `AssetEconomicMeasurement`, `EquityEconomicMeasurement`, `LiabilityEconomicMeasurement`, `IncomeEconomicMeasurement` and `ExpenseEconomicMeasurement`.

The class `Value` with sub-classes `EquityValue`, `ResidualValue`, `TotalAssetValue` and `TotalLiabilityValue` were created to enable the formalisation of the CffFR definition for equity. The problems experienced when modeling the CffFR equity definition was reported during the discussion of Iteration 1 (section 7.3.4).

The `is_a` relationships between the `EconomicMeasurementClass` and its sub-classes as formalised in Protégé is schematically illustrated below in Figure 7.22.

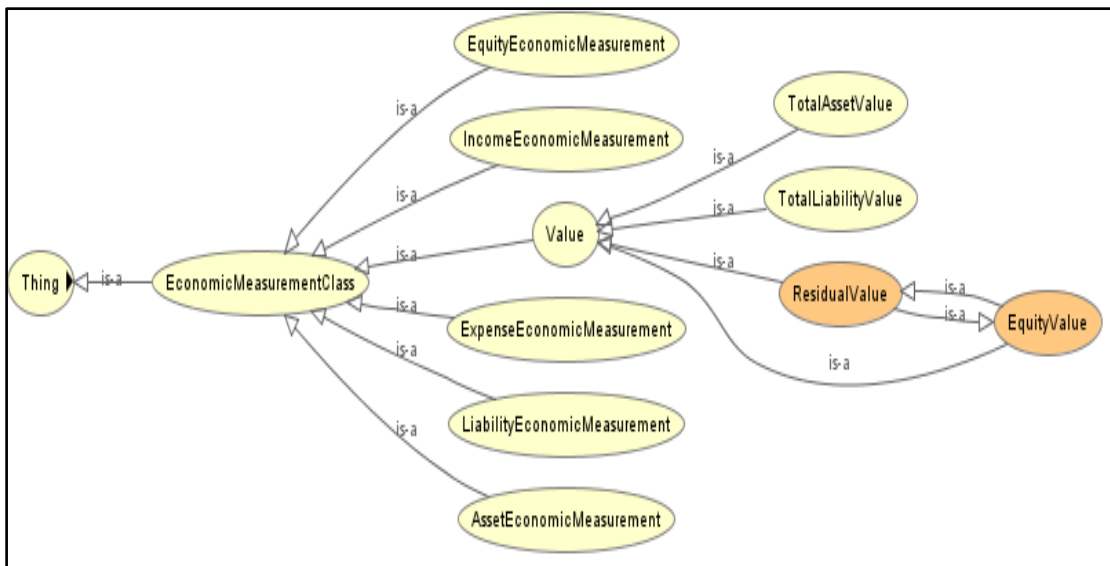


Figure 7.22: Economic Measurement Class: `is_a` relationships

The complex usage of the `EconomicMeasurementClass` is indicated in Figure 7.18 to illustrate the importance of the `EconomicMeasurementClass`. A detailed description of the usage of the classes is included in Appendix E – Ontology engineering decisions.

The screenshot displays the Protege ontology editor interface. The top navigation bar shows chapters 1 through 10, with 'Ch 7' highlighted. The main window title is 'CFRR (http://www.semanticweb.org/ontologies/2015/1/CFRR.owl)'. The left pane shows a class hierarchy starting with 'Thing' and including 'EconomicMeasurementClass' and its subclasses like 'AssetEconomicMeasurement', 'EquityEconomicMeasurement', etc. The central pane, titled 'Usage: EconomicMeasurementClass', shows 'Found 15 uses of EconomicMeasurementClass' and lists various instances and relationships such as 'AssetEconomicMeasurement SubClassOf EconomicMeasurementClass', 'EconomicMeasurementClass DisjointClasses: EconomicMeasurementClass, RealityClass, ReportingClass, TemporalClass', and 'EquityEconomicMeasurement SubClassOf EconomicMeasurementClass'. The bottom pane, titled 'Description: EconomicMeasurementClass', shows 'Equivalent To' and 'SubClass Of' relationships, including 'IsEconomicMeasurementOf some RealityClass' and 'IsPortrayedByReporting some ReportingClass'.

Figure 7.23: Economic Measurement Class – Usage

Figure 7.24 illustrates the complexity of relationships the EconomicMeasurementClass and its sub-classes are involved in. The relationships are called and modelled as ObjectProperties in Protégé. A detailed description of the usage of the ObjectProperties is included in Appendix E – Ontology engineering decisions.

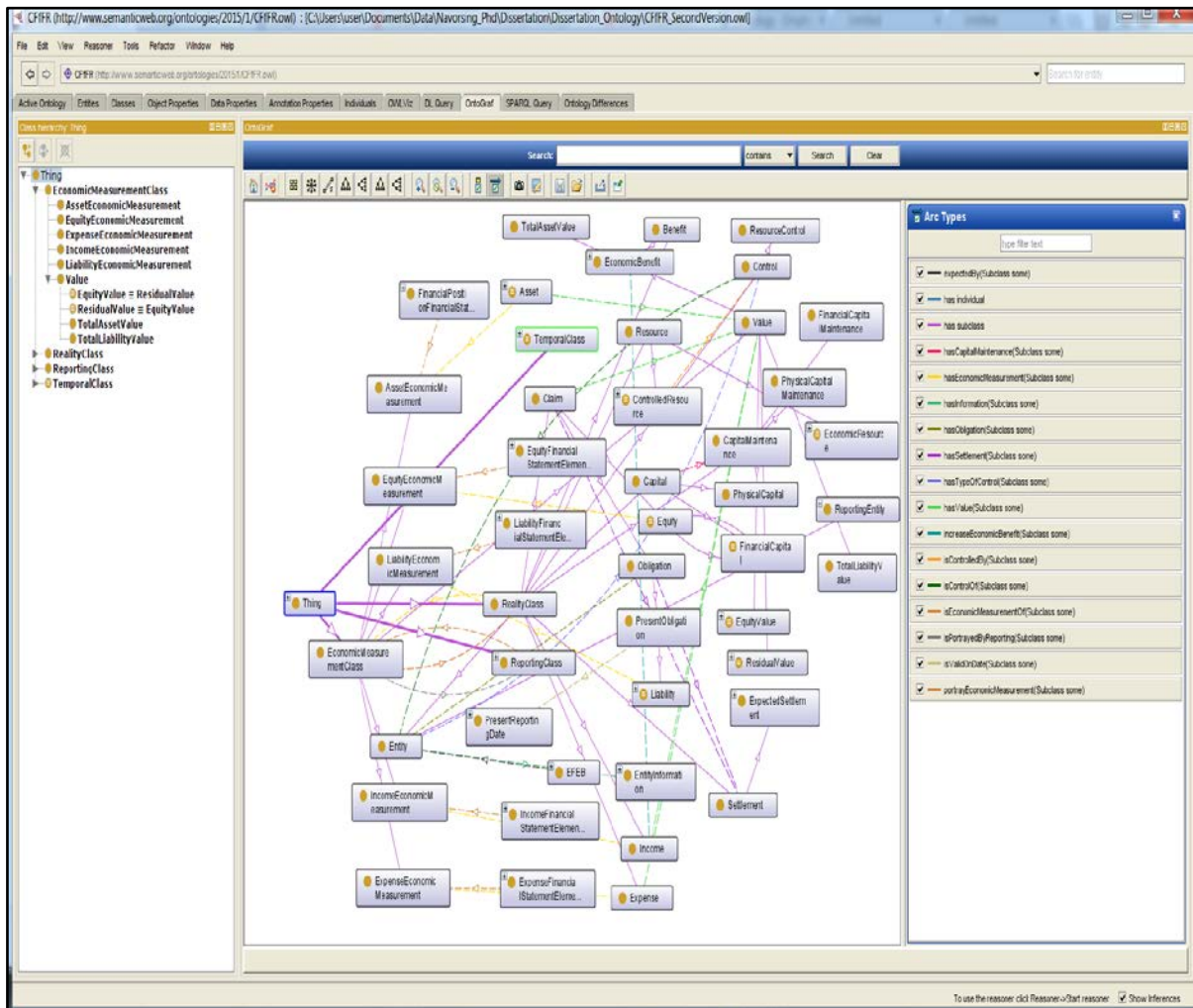


Figure 7.24: Economic Measurement Class: Object Property relationships

c) Reality Class

When analysing the classes identified during CFRR ontology Version 1, the basic characteristics of these classes were considered. It was realised that some classes relate to the reality of economic activities. These classes were grouped and classified as sub-classes under a class called the RealityClass. The values of the RealityClass and its sub-classes are the most basic classes providing decision-useful information to users of financial reports. The sub-classes contained in the definitions of the classes Asset, Liability, Equity, Income and Expense are included under the super class RealityClass. It is assumed that all the classes reported on in financial reports can be sub-classified under one of the classes currently modelled under the RealityClass.

The modeling of the definitions for `Asset`, `Liability` and `Equity` was discussed and reported on during the modeling attempts of Iterations 1 and 2.

The definition provided in the CFfFR for `Income` is (IASB, 2010a:A43):

“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.”

The following classes were identified in the definition of `Income`:

- **RealityClass** with sub-classes, `EconomicBenefit`, `Asset`, `Liability`, `Equity`, `Income` and `Shareholder`.

The identification of the class `Shareholder` is a modeling decision based on the use of “*equity participants*” in the definition.

- **TemporalClass** with sub-classes, `TemporalPeriod`, `PastReportingPeriod`, with `TemporalInstant`, `ConsiderationDate` and `PresentReportingDate` also included being able to model the accounting period referred to in the definition.

The classes mentioned under the class `TemporalClass` are all the result of implied domain knowledge and is not explicitly mentioned in the definition. The domain knowledge is implicitly contained in the term “*accounting period*”.

- **ReportingClass** with sub-classes `FinancialStatement`, `StatementOfProfitOrLossAndOtherComprehensiveIncome`, `FinancialPerformanceFinancialStatementElement`, `IncomeFinancialStatementElement`.

All the classes identified under the class `ReportingClass` are based on implicit domain knowledge and it is not explicitly stated in the definition of income.

- **EconomicMeasurementClass:**

The definition does not mention anything related to value or economic measurement. It is assumed that “enhancements of asset” means the increase in the value of assets. This is ambiguous as it is not clear “what” of an asset will be enhanced. Will there be more assets in the number of assets? Alternatively, will the economic measurement of a single asset or a group of assets increase? Does asset refers to the element asset or a specific asset (an instance) or a sub-category of the class `Asset`? In order to formally model a definition, that specific definition must be explicitly clear and without any unintended meanings.

The following Object Properties were identified in the definition of `Income`:

- `fromWhichInflow`, (based on “*increases, inflows or enhancements, and contributions*”), `fromWhichOutflow` (based on “*decreases*”).

With the information provided in the CFFR it is not possible to formally represent a definition for the class `Income` at this stage.

The definition provided in the CFFR for `Expense` is (IASB, 2010a:A43):

“Expenses are decreases in economic benefits during the accounting period in the form of outflows or depletions of assets or incurrences of liabilities that result in decreases in equity, other than those relating to distributions to equity participants.”

The following classes were identified in the definition of `Expense`:

- **RealityClass** with sub-classes, `EconomicBenefit`, `Asset`, `Liability`, `Equity`, `Income` and `Shareholder`.

The identification of the class `Shareholder` is a modeling decision based on the use of “*equity participants*” in the definition.

- **TemporalClass** with sub-classes, `TemporalPeriod`, `PastReportingPeriod`, with `TemporalInstant`, `ConsiderationDate` and `PresentReportingDate` also included being able to model the accounting period referred to in the definition.

The classes mentioned under the class `TemporalClass` are all the result of implied domain knowledge and is not explicitly mentioned in the definition. The domain knowledge is implicitly contained in the term “*accounting period*”.

- **ReportingClass** with sub-classes `FinancialStatement`, `StatementOfProfitOrLossAndOtherComprehensiveIncome`, `FinancialPerformanceFinancialStatementElement`, `IncomeFinancialStatementElement`.

All the classes identified under the class `ReportingClass` are based on implicit domain knowledge and it not explicitly stated in the definition of income.

- **EconomicMeasurementClass:**

The definition does not mention anything related to value or economic measurement. It is assumed that “outflow or depletion of asset” means the decrease in the value of assets. This is ambiguous as it is not clear “what” of an asset will be decreased. The same unintended meaning present in the definition of income is also present in the definition of expense.

The following Object Properties were identified in the definition of `Expense`:

- fromWhichInflow, (based on “incurrence”), fromWhichOutflow (based on “outflows or decreases”).

Due to the circular nature of the definitions for Income and Expense, the references to Asset, Liability and Equity and the implied knowledge, it was not possible to formally represent the definitions for Income and Expense.

The following is a graphical presentation of the is_a relationships of the class RealityClass and its sub-classes:



Figure 7.25: Reality Class: is_a relationships

d) Reporting Class

The information included in the class ReportingClass was obtained from a specimen financial report. As a financial report is the target in which information useful for decision-making is published, it was deemed necessary to formally represent a financial report.

The direct siblings of ReportingClass are Report, Statement, FinancialStatementElement and FinancialReportInformation. The distinction between a financial report and a statement is modelled by classifying Statement separate

from `FinancialReport`. A statement is not a financial report and a financial report is not a statement. Statement has a sub-class `FinancialStatement` that is further subdivided into different types of financial statements, `StatementOfFinancialPosition`, `StatementOfProfitOrLossAndOtherComprehensiveIncome`, `StatementOfChangesInEquity` and `StatementOfCashFlows`. A `FinancialStatement` can be included in a `FinancialReport`, but it is a separate class from the class `FinancialReport`.

The use of the class `Element` was discussed in section 7.5.1. It was concluded that, according to dictionaries consulted, the word element could refer to an essential or characteristic part of something. Financial statements can be divided into sections containing information specific to certain classes known in the financial reporting domain as financial performance and financial position.

A part of a financial statement reporting on the financial position of a reporting entity is categorised as a sub-class `FinancialPositionFinancialStatementElement` of the `FinancialStatementElement`. In the `FinancialPerformanceFinancialStatementElement` sub-class of the class `FinancialStatementElement` information regarding the financial performance of reporting entity is reported.

The `FinancialPositionFinancialStatementElement` is refined by the sub-classes `AssetFinancialStatementElement`, `EquityFinancialStatementElement` and `LiabilityFinancialStatementElement`.

The `FinancialPerformanceFinancialStatementElement` is refined by the sub-classes `ExpenseFinancialStatementElement` and `IncomeFinancialStatementElement`.

For the purpose of financial reporting the class `Report` is further refined by the sub-classes `FinancialReport` and `AnnualFinancialReport`. `FinancialReport` is a report containing financial information of a reporting entity. An `AnnualFinancialReport` is a type of `FinancialReport` produced annually reporting on the economic activities of a reporting entity for the previous financial period, usually a 12-month period. Another class identified is financial information contained on a financial report classified as `FinancialReportInformation`. `FinancialReportInformation` is refined by the sub-classes `EntityInformation` and `NotesToFinancialStatements`. It is not claimed that the sub-classes are a complete collection of all the information that are provided on a financial report, but it illustrates how the different types of information can be classified.

The illustration below (Figure 7.26) portrays the `is_a` relationships of the class `ReportingClass`.

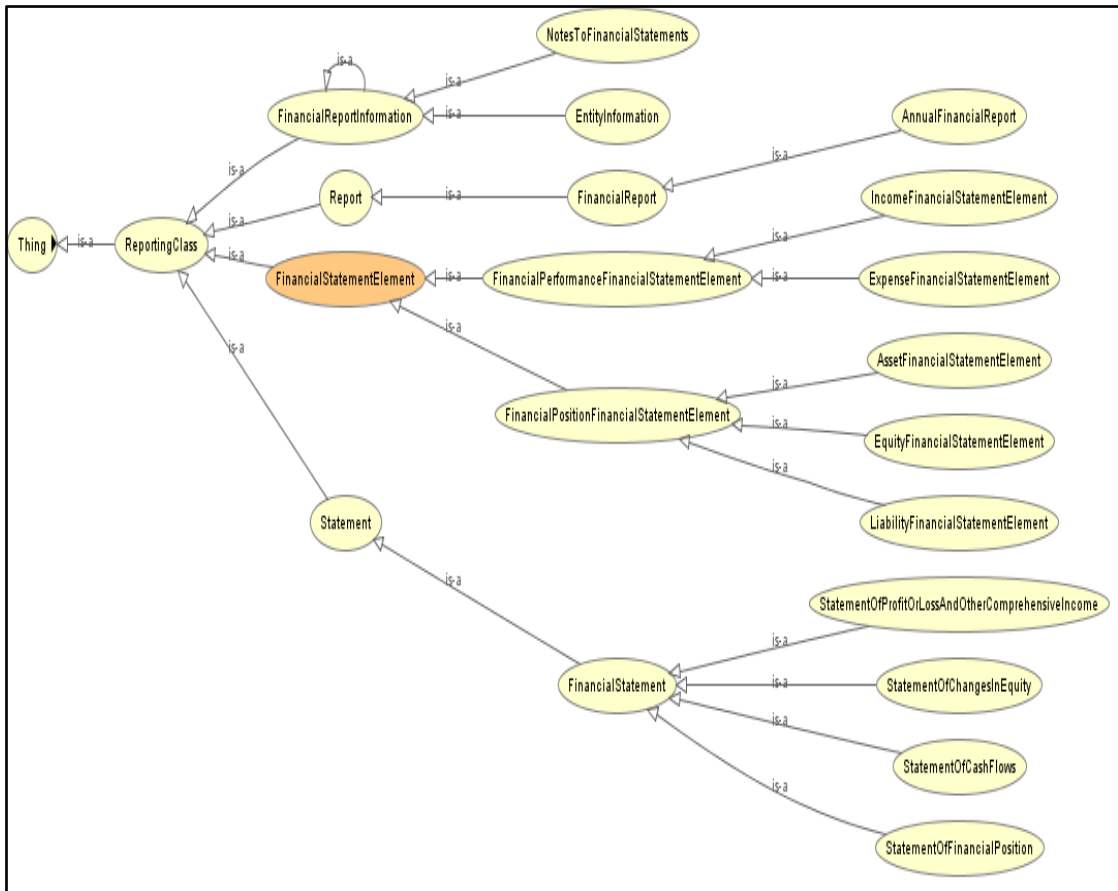


Figure 7.26: Reporting Class: is_a relationships

e) Temporal Class

The class TemporalClass was discussed in detail in section 7.2.3. The distinction made between the sub-classes TemporalInstant and TemporalInterval enables the CFfFR ontology to formally represent the notion time as perceived in the financial reporting domain.

Figure 7. is a graphical illustration of the is_a relationships of the class TemporalClass.

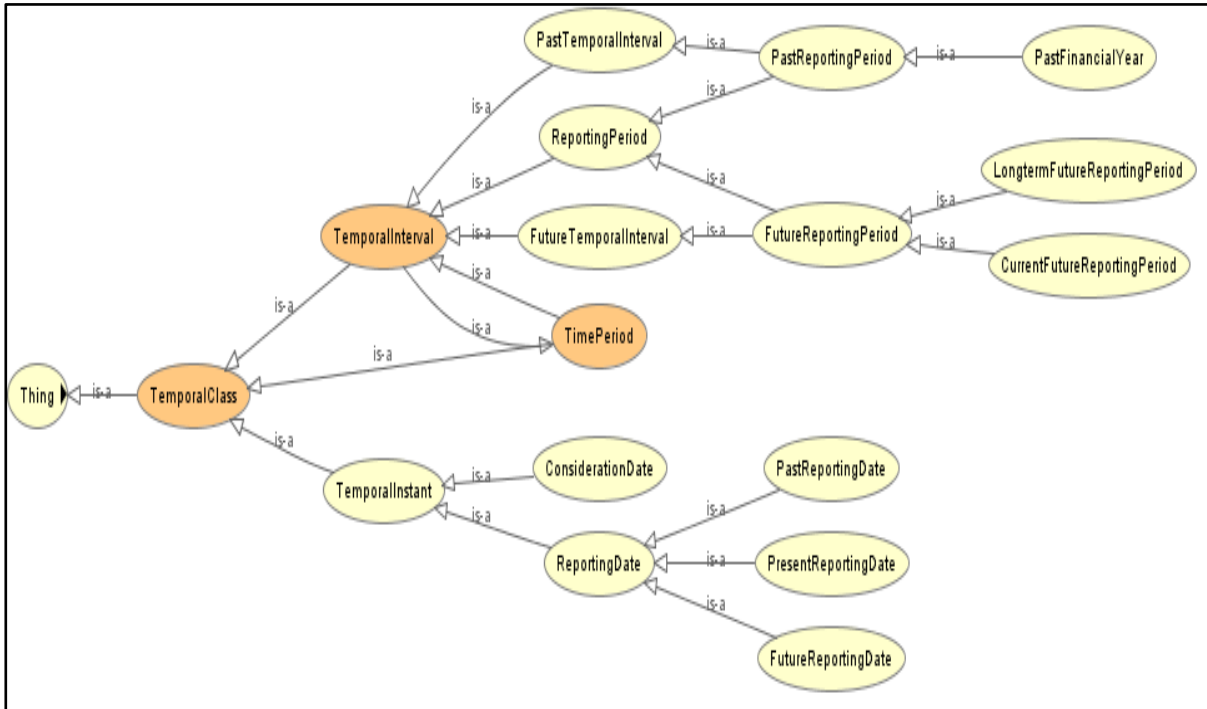


Figure 7.27: Temporal Class: *is_a* relationships

The following illustration (Figure 7.28) is schematic presentation from Protégé portraying the *is_a* relationships of the CFFR ontology's four main classes and their respective sub-classes:

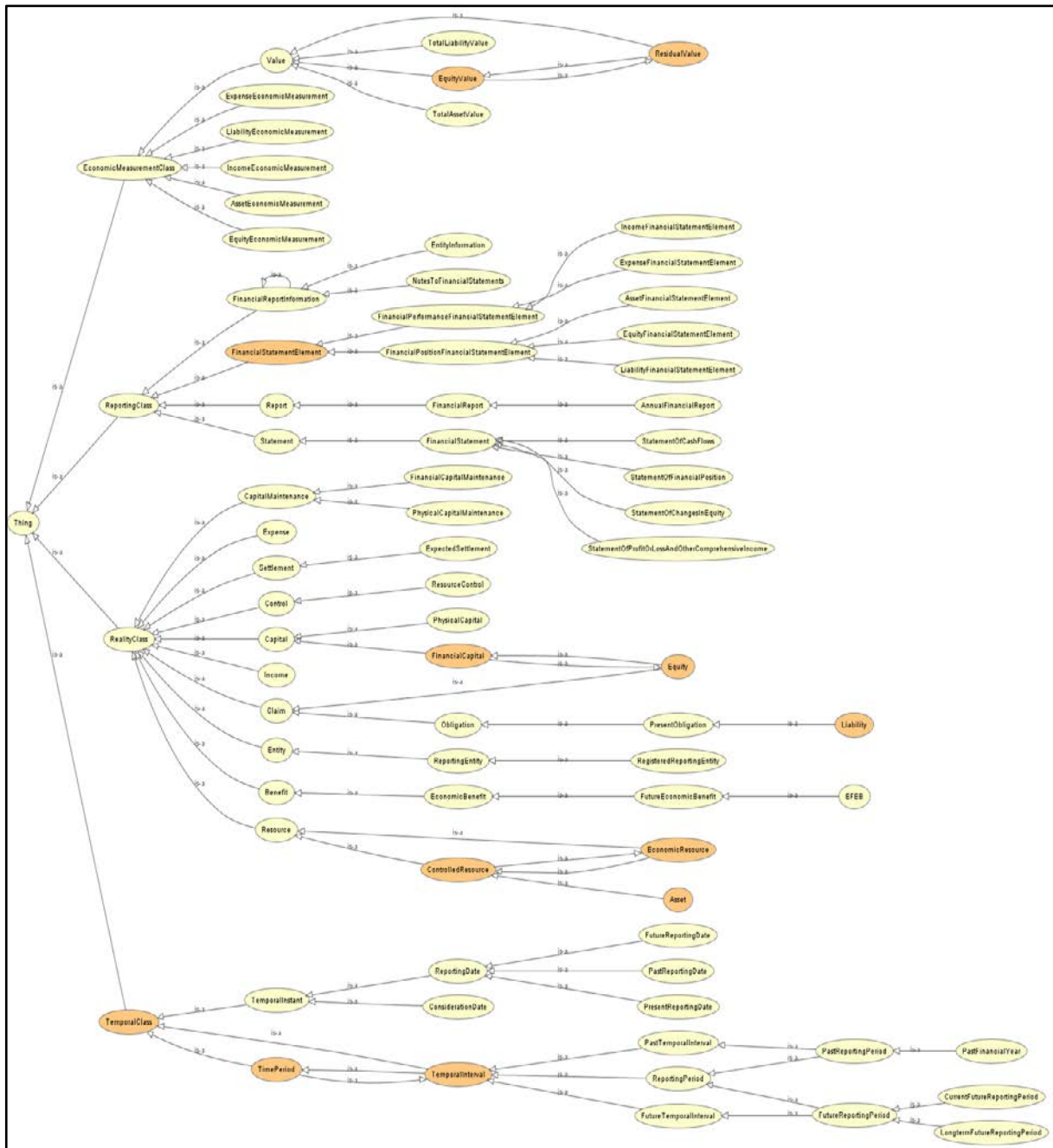


Figure 7.28: CFFR ontology – Version 2 *is_a* relationships

f) Object Properties

Object Properties indicates the relationships between classes in Protégé. As the financial reporting domain has not yet been formalised, standard Object Properties have not been created for the domain. Part of the analysis of the classes in the CFfFR was to determine the relationships between these classes and then to formalise these relationships using the OWL language embedded in Protégé. The ObjectProperties presented below (Figure 7.29) were created during the formalisation process of the identified classes.

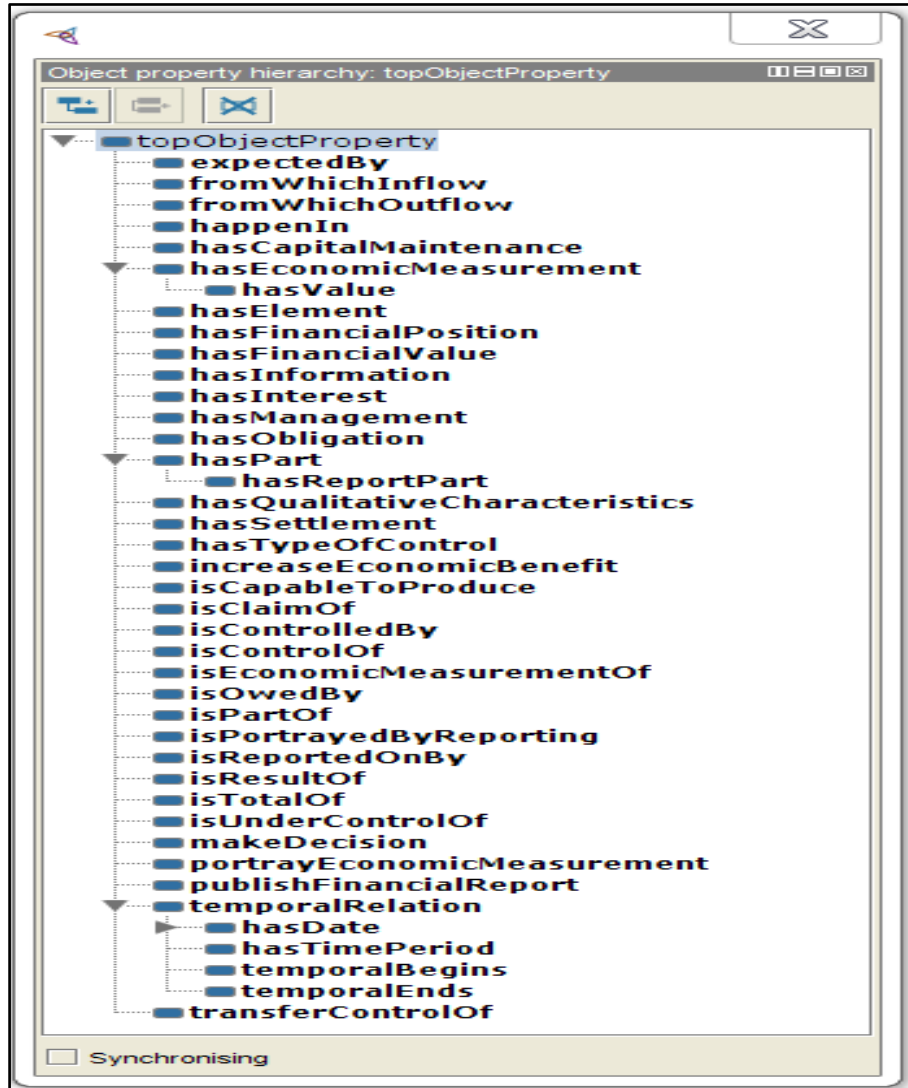


Figure 7.29: CFfFR Version 2 - Object Properties

Figure 7.30 is a schematic presentation of all the classes and relationships of the second version of the CFfFR ontology.

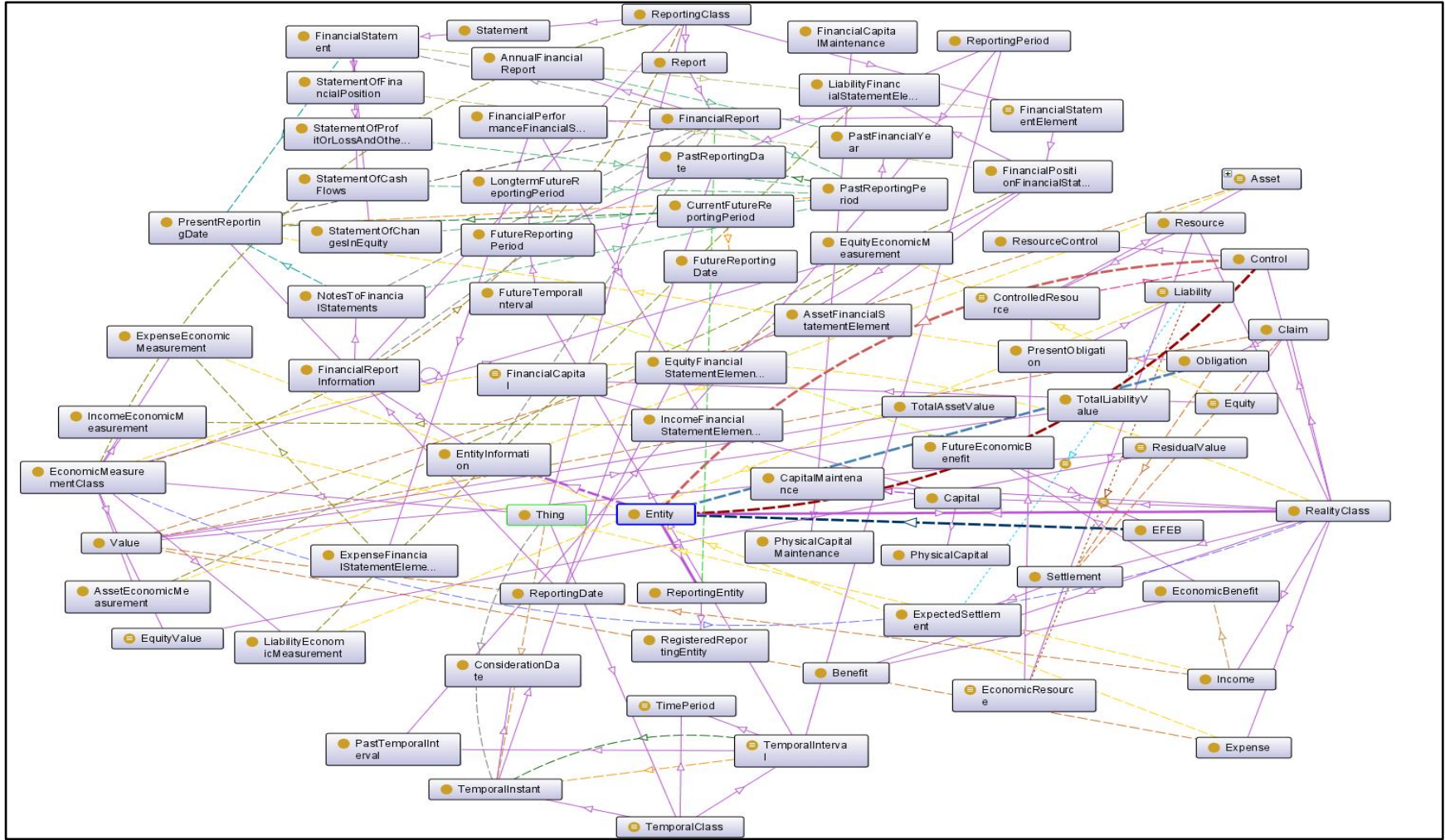


Figure 7.30: CFfFR Version 2 – all relationships

7.7 Verification

In building the CFfFR ontology, the FEDS Human Risk & Effectiveness evaluation strategy and the Technical Risk & Efficacy strategies culminated into the final artefact during Iteration 4. By building the CFfFR ontology, the main research question and the three sub-research questions were answered and the FEDS evaluation strategy completed.

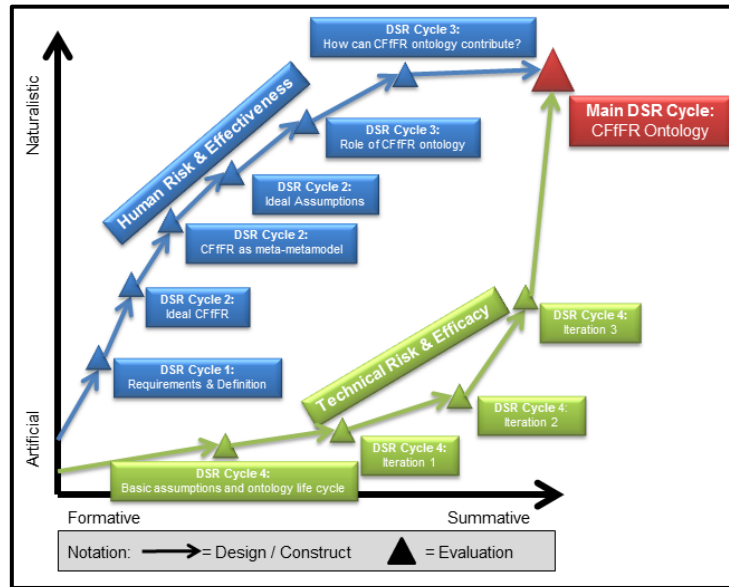


Figure 7.31: FEDS Evaluation Strategy

The formal domain ontology of the CFfFR complies with more of the requirements and definition of a global CFfFR than the natural text CFfFR. The findings made through building the CFfFR ontology in two versions and four Iterations indicate how the CFfFR can be improved towards a global CFfFR.

7.8 Conclusion

During DSR Cycle 4 (Chapter 7) a domain ontology of the basic classes and relationships of the CFfFR providing decision-useful information was formalised. The guidelines as provided in the OLC (Neuhaus et al., 2013) were followed in the building process. The CFfFR ontology went through four refining Iterations.

The first challenge solved was to formalise the notion of time and the manner in which it functions in the financial reporting domain (section 7.2.3). The classes `TemporalClass`, `TemporalInstant` and `TemporalInterval`, with their respective sub-classes, are sufficient to model how time functions in the financial reporting domain.

During Iteration 1 of building the CFfFR ontology, how to formally represent the basic classes and their relationships as contained in the definitions provided in the CFfFR for the classes `Asset`, `Equity` and `Liability` (section 7.3) were experimented with. Some inconsistencies, unintended meanings (ambiguities) and implicit domain knowledge assumed in the CFfFR were detected and reported. It was not possible to formalise the equity definition provided in the CFfFR without making modeling

decisions and assuming the meaning and impact of implicit knowledge not explicitly mentioned.

The definitions for assets, equity and liabilities were refined in Iteration 2 using additional information provided by the IASB in DP/2013/1 (IASB, 2013a) (section 7.3.5). In order to model the definitions in a logically consistent manner the definitions were analysed with reference to the rest of the CFfFR in order to identify the most basic classes in a statement of financial position (section 7.4.1). Based on the formal representation of the classes `Asset`, `Equity` and `Liability` definitions written in natural text were proposed that are internally coherent and logically consistent. A comparison of the different definitions is provided in Table 7.2.

In Iterations 3 and 4 the CFfFR ontology was developed. During the initial planning to build the CFfFR ontology it was assumed that the natural text of the CFfFR document would provide enough information to complete the CFfFR ontology. The assumption was based on the claim of the CFfFR that it contains the basic postulates and principles needed to give guidance in order to set accounting standards that would result in decision-useful information for the users of financial reports. During the attempt to develop the CFfFR ontology in Iteration 3, it was realised that it was not possible to develop the CFfFR ontology because of too much assumed domain knowledge in the CFfFR as well as the absence of too much basic information essential to build the CFfFR ontology.

The problems encountered in Iteration 3 were addressed by developing a decision filter process (Figure 7.19). The decision process explicitly illustrates the decision process unknowingly followed by preparers of financial statements to report decision-useful information. The process starts with the initiation of an economic activity (instance) of a reporting entity and ends when it is published in a financial report. Although most of the information is provided in the CFfFR, some critical concepts (classes) are not included in the CFfFR. Some of the lacking information is available in accounting standards such as IAS1 and some was obtained by analysing a specimen financial report.

The information lacking from the CFfFR is of critical importance to the CFfFR ontology in order to answer the competency questions set during Phase 1 (section 7.2.1) of the OLC.

The CFfFR document was analysed and the information in the CFfFR was classified according to the basic classes and the information informing these classes. The analysis is schematically presented in Figure 7.21. With the additional information and the explicit knowledge of the decision process, it was possible to identify four basic classes of the CFfFR ontology. In this study, these classes are called the `EconomicMeasurementClass`, the `RealityClass`, the `ReportingClass` and the `TemporalClass`. In Iteration 4, the CFfFR ontology was developed using the decision process model and the ontology analysis around the four basic classes. The `ObjectProperties` (relationships) were developed and tested for inconsistencies using the reasoner FaCT++. The result is an inherently coherent and logically consistent CFfFR ontology built around the four basic classes and their



relationships. A schematic presentation of the identified classes connected with the relationships is provided using the Onto Graf function of Protégé in Figure 7.30. The result is a formal representation of the basic classes and their relationships (a CFFR ontology) needed to provide decision-useful information to the users of financial reports.

In Section D, the findings made during the execution of the research plan is evaluated in Chapter 8 and the contributions of the research project are reported in Chapter 9.

SECTION D – EVALUATION, FINDINGS AND CONTRIBUTION

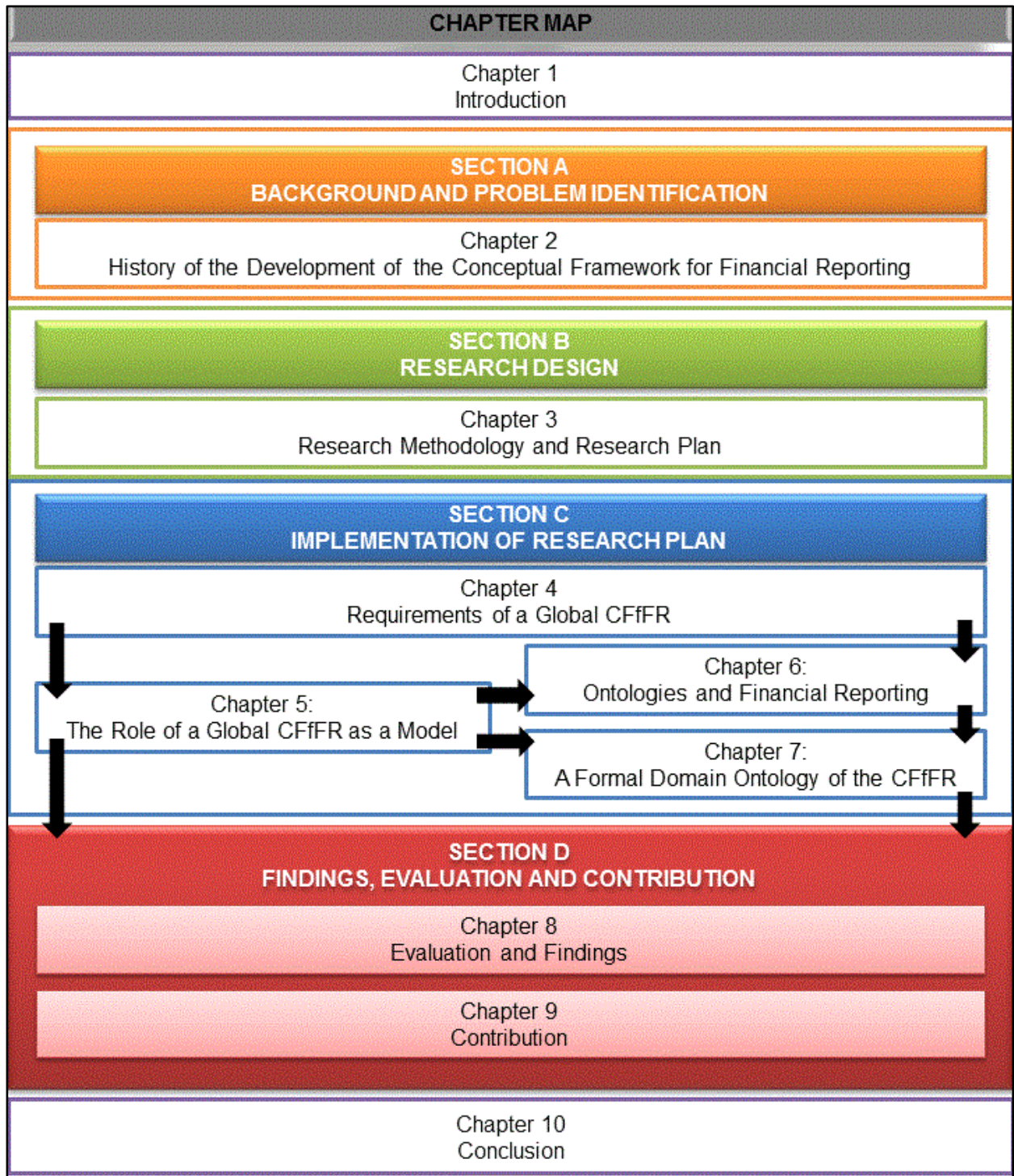


Figure 7.32: Chapter map: Section D

INTRODUCTION

In Section D of the study, the research conducted in this study is evaluated to indicate if the research problem was solved by answering the research questions. Section D contains two chapters. In Chapter 8, the findings for the DSR approach using various research techniques are presented. The findings are presented according to the structure of the DSR strategy cycles. The new knowledge obtained during a DSR Cycle contributed towards the next cycle and culminated into answering the main research question in DSR Cycle 4. As the DSR Cycles mainly coincide with the different sub-research questions, Chapter 8 is structured to discuss the findings as they relate to the sub-research questions. The findings are evaluated to determine if it answer a related sub-research question.

In Chapter 9, the research contributions towards the body of knowledge made by the study are highlighted. The contributions towards the body of knowledge are structured according to the discipline from which a specific contribution originates.

CHAPTER 8

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8 FINDINGS AND EVALUATION

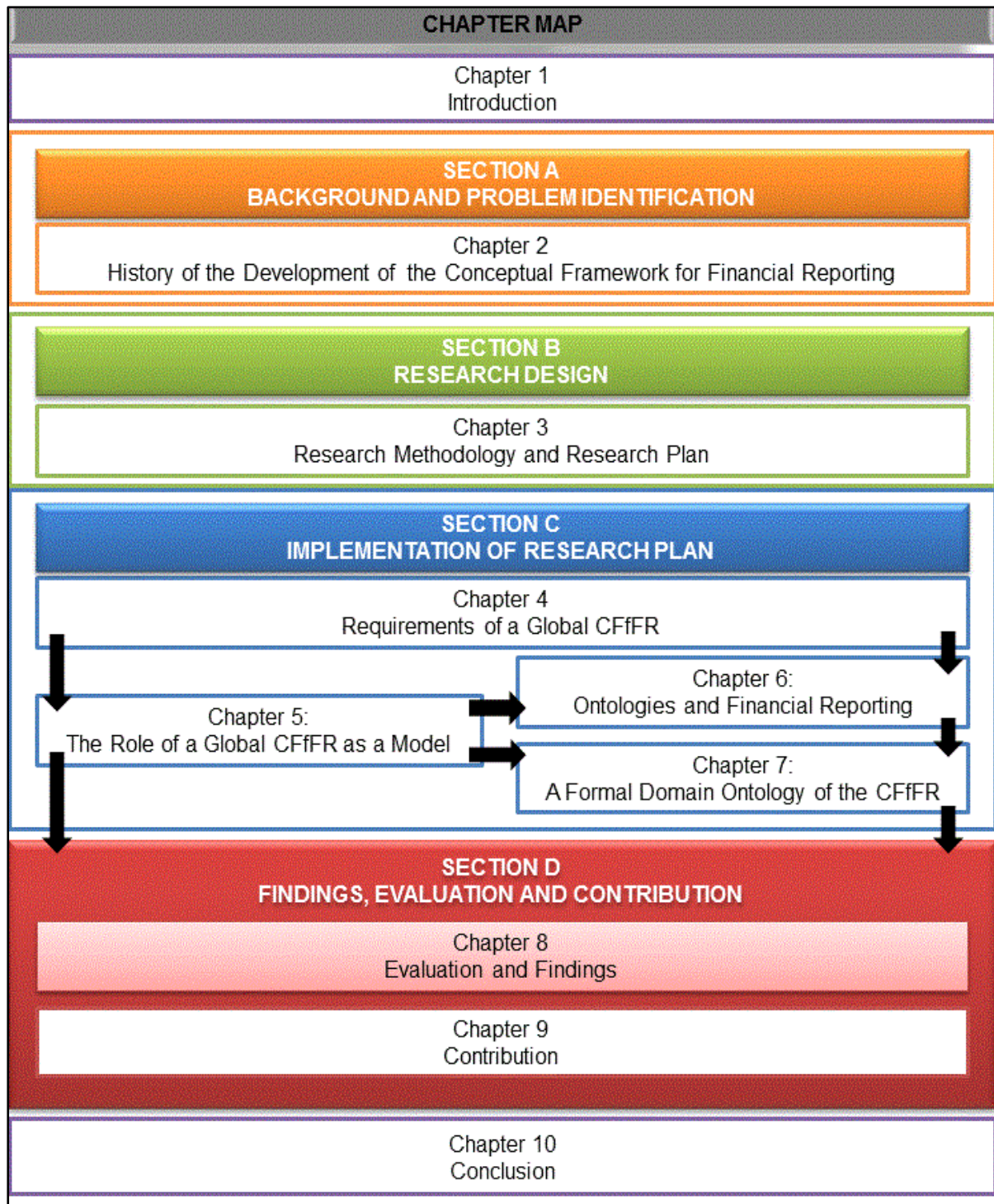


Figure 8.1: Chapter map: Chapter 8

8.1 The Research Problem and Research Questions Answered

In the literature review (Chapter 2) the evolutionary development of the CFfFR was described using a system of stimulus/response (Salvary, 1979). In this system, the response often became a stimulus for prompting another response. In Table 2.3, a summary is provided on how the political, legislative, scientific, economic and business societies responded to the different stimuli and development by these different societies. The reaction of the accounting profession to these demands and other developments contributed towards the development of accounting practices and theories to respond to the demands of parties interested in financial information.

In Table 2.3, the discussion on the reaction of the accounting profession to the demands of users of financial information concluded with the publication of “*The Conceptual Framework for Financial Reporting*” by the IASB (2010a) on September 28, 2010. After World War II, a demand developed for one set of high standard accounting standards that are *principally based, internally consistent and internationally converged*. The research problem identified is that there is a need for a global CFfFR that provides definitions and other fundamental concepts that are a sound foundation for the development of accounting standards that are principally based, internally consistent and internationally converged, but such a global CFfFR does not exist.

Adopting the stimulus/response system, discussed during the literature review (Chapter 2), the research problem was approached by considering current technological developments in the field of computing, which could assist with a response to the challenges posed to the accounting profession to develop a globally acceptable CFfFR.

Based on the research problem, the **main research question** answered in this study is:

How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

By answering the following sub-research questions, it was possible to answer the main research question:

Sub-research Question 1 (SRQ 1):

- What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

Sub-research Question 2 (SRQ 2):

- How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

Sub-research Question 3 (SRQ 3):

- How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

In order to answer the research questions and solve the research problem a DSR strategy was followed by completing four DSR Cycles. During the Development Steps of the DSR Cycles, various artefacts were developed which served as evaluation markers according to the FEDS evaluation strategy.

In order to determine if the main and sub-research questions were answered, artefacts aimed at answering the respective questions were constructed and evaluated during the DSR Cycles of the design process¹¹⁸ and can be viewed as “micro-evaluations” (Vaishnavi & Kuechler, 2013). The knowledge contributions from DSR Cycles 2 and 3 spinning from the Development Steps were evaluated “by a ‘thought experiment’ in which those parts of the design were mentally exercised” by the researcher (designer) (Vaishnavi & Kuechler, 2013:22). The various artefacts were evaluated to be successful if they contributed towards building the CFfFR ontology and ultimately answering the main research question. A formal evaluation of the final artefact, the formal domain ontology of the CFfFR, were performed by determining if the final artefact contributes knowledge towards the construction of a CFfFR that could be globally accepted in section 7.7

Figure 8.2 is a schematic representation of how the research questions were answered:

¹¹⁸ This is in accordance with the evaluation practice described by Vaishnavi and Kuechler (2013).

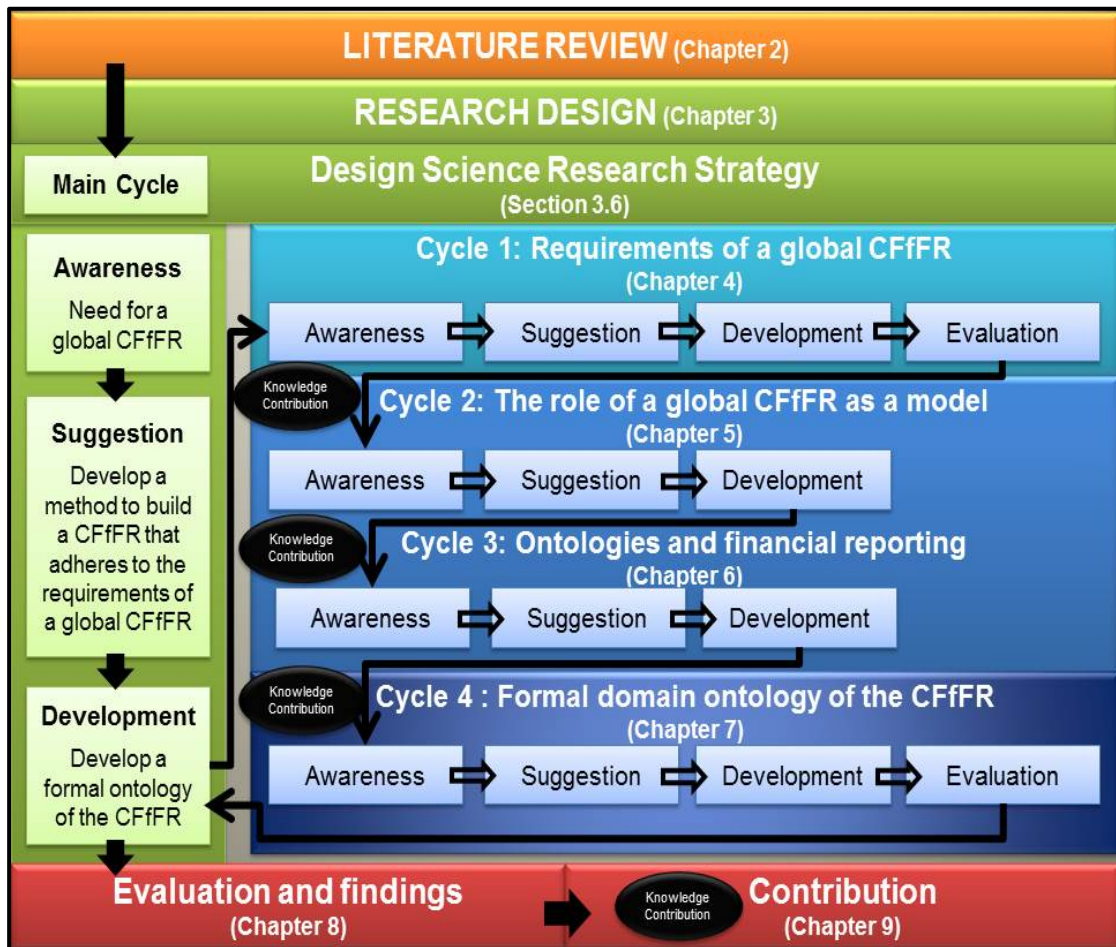


Figure 8.2: DSR as research strategy

In sections 3.6.1 to 3.6.5, the DSR strategy to answer the research questions was discussed. The following matrix indicates how the DSR strategy answered the research questions. The matrix is explained in section 3.9.

Table 8.1: Matrix of research questions and DSR strategy

RESEARCH QUESTION	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
MAIN RQ	√				√
SRQ 1		√	√		
SRQ 2			√		
SRQ 3				√	√

Table 8.2 illustrates how the artefacts developed during the DSR Cycles contributed towards answering the research questions.

Table 8.2: Summary of artefacts contributing towards answering the research questions in the DSR Cycles

	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
ARTEFACT	Development Step moves to DSR Cycle 1.	Construct: Requirements & Definition of a global CFfFR. (Sections 4.6 and 4.7)	Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4). Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4).	Model: The role of the ideal CFfFR as a formal domain ontology according to OMG four level hierarchy (section 6.4.).	Construct: <ul style="list-style-type: none"> Basic assumptions to build a formal domain ontology of the CFfFR (section 7.2.2). Use of OLC in financial reporting domain (section 7.2)
			Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5). Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5).	Construct: Conceptualisation on how a CFfFR ontology could contribute towards the research questions (section 6.4.3.).	Model: Iteration 1 (section 7.3): <ul style="list-style-type: none"> Modeling of time. Modeling definitions of asset, liability and equity.
	Model: The CFfFR ontology indicating internal incoherence's, logical inconsistencies, implied knowledge and incompleteness of CFfFR (sections 7.4, 7.5 and 7.6).		Construct: Ideal assumptions provide vocabulary and conceptualisation to communicate regarding ideal and possible global CFfFR (section 5.4).		Model: Iteration 2 (section 7.4): <ul style="list-style-type: none"> Identification of basic classes and relationships in SFP element definitions. Proposed SFP element definitions, which are logically consistent.
					Model: Iteration 3 (section 7.5): <ul style="list-style-type: none"> Identification of key classes and relationships in the CFfFR ontology. Decision process model.
					Model: Iteration 4 (section 7.6): Building the CFfFR ontology.
	Main RQ	SRQ 1	SRQ 1 SRQ 2	SRQ 3	SRQ 3 Main RQ

8.2 Sub-Research Question 1 (SRQ 1)

What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

The first sub-research question was answered during DSR Cycle 1 (Chapter 4) and DSR Cycle 2 (Chapter 5) (Table 8.2).

8.2.1 SRQ 1: Findings

In Chapter 4, a systematic review was conducted to determine the requirements for and definition of a global CFfFR. As the requirements and definition are not officially published by the standard setting bodies (the IASB and FASB),¹¹⁹ literature dealing with the requirements of a global CFfFR was identified and analysed. The requirements of a global CFfFR are provided in section 4.6.

The data collected to determine the requirements was documented in Part A of Chapter 4. In Part B, the requirements were classified in two categories. Under Category 1 (section 4.6.1), the characteristics and perceptions surrounding a global CFfFR are summarised. In Category 2 (section 4.6.2), the content requirements for a global CFfFR are listed.

The first characteristic in Category 1 is that a standard setting body should have credibility and legitimacy (section 4.6.1a) in order for the accounting standards published by such a standard setting body to be accepted in the accounting community. It was determined that the IASB is recognised as a credible organisation due to its rigorous process to set accounting standards and the wide acceptance of the IFRS standards. The existence of the CFfFR contributes to the credibility of the IASB.

Derived from the functional and technical needs of a global CFfFR, the necessity for a body of shared domain knowledge with the objective to improve financial reporting through fundamental concepts (section 4.6.1b) was established. The objective of the CFfFR is to improve financial reporting by identifying and formulating fundamental concepts of financial reporting (section 4.6.1c). Another finding was that for a theory to be globally acceptable, it should be based on an agreed paradigm within a specific knowledge community (section 4.6.1d). It was found that the CFfFR is based on such an agreed paradigm known as decision-usefulness of financial information for the users of financial reports.

The content requirements of a global CFfFR listed below were identified in section 4.6.2.

¹¹⁹ The FASB literature up to and until the CFfFR was published in 2010 is included in the study as the CFfFR is based on the FASB conceptual framework.

- A global CFfFR should be *complete and comprehensive*. The postulates and principles in a global CFfFR should cover all possible transactions and other events and conditions deemed useful for decision-making. The level of abstraction should be sufficient to provide a comprehensive summary of the fundamental concepts from which other concepts can be derived.
- A global CFfFR should be *internally coherent* to provide consistent guidance to standard setters.
- The fundamental concepts of a global CFfFR should be formulated *clearly and unambiguously* with no unintended meanings
- A global CFfFR should be *logically consistent* to achieve scientific credibility in an accounting community consisting of different cultures.

A schematic summary of the requirements summarised under Category 1 and Category 2 are presented in Figure 4.6. A definition of a global CFfFR was derived from the identified requirements. The proposed definition of a global CFfFR was formulated as:

A conceptual framework for financial reporting is an internally coherent and logically consistent representation of fundamental concepts that unambiguously prescribes the nature, function and limits of financial reporting.

The requirements and definition of a global CFfFR are the first artefact and point of knowledge contribution on the Human Risk & Effectiveness verification strategy (Figure 4.4).

With the knowledge contribution obtained from DSR Cycle 1 as basis, a new Awareness Step regarding the ideal role of a global CFfFR within financial reporting was entered into in DSR Cycle 2 (Figure 3.3).

In order to determine the ideal role of a global CFfFR, an interdisciplinary investigation was performed. In Chapter 5, it was investigated if a global CFfFR can function as a model within the financial reporting domain. The role of a global CFfFR was investigated from philosophy of science and computing perspectives.

From a philosophy of science perspective, it was founded that a global CFfFR could serve as a model of isolation by idealisation (section 5.2.1). A global CFfFR can be viewed as a representation by surrogate systems (section 5.2.2) and the CFfFR ontology can function as a truth container or a truth-bearing model (section 5.2.3). The model formula as discussed by Mäki (2008; 2009; 2011) and Grüne-Yanoff and Mäki (2014) was applied to determine the role of the CFfFR in the financial reporting domain. The applicability of the model system to the CFfFR was indicated. Using the adopted model theory of an idealised model as a truth-bearing model, idealised assumptions for an ideal CFfFR were formulated (section 5.4) based on the literature review (Chapter 2) and the requirements and definition proposed in Chapter 4. The idea of an ideal CFfFR is the first artefact of DSR Cycle 2 and the second point of knowledge contribution on the Human Risk & Effectiveness verification strategy.

Once it was determined that the role of the CFfFR in the financial reporting domain can be seen as an ideal truth-bearing model, the use of models in computing was examined. The value of models and their use in computing was applied to the financial reporting domain and it was determined that if the CFfFR is viewed as a model it contributes towards the understanding of the role of the CFfFR within the financial reporting domain (section 5.3.3). According to a view of models in computing, the CFfFR can be viewed as a token model in relationship to accounting standards and a financial report (section 5.3.4). It was found that within the financial reporting domain the CFfFR has the role and function of a meta-metamodel (section 5.3.5).

Once the role of the CFfFR as a meta-metamodel in the financial reporting domain was established, the idealised assumptions identified during the investigation in section 5.2 were expanded to accommodate the role of the CFfFR as a meta-metamodel. The role of the CFfFR as a meta-metamodel was illustrated in Figure 5.12. Accordingly, the OMG four level hierarchy of models, metamodels and models must adhere to classes and relationships described in models of a higher hierarchy for the model system to be inherently coherent and logically consistent.

The role of a global CFfFR as an idealised meta-metamodel differs from the status of the CFfFR. The status of the CFfFR is stated as follows:

“This Conceptual Framework is not an IFRS and hence does not define standards for any particular measurement or disclosure issue. Nothing in this Conceptual Framework overrides any specific IFRS” (IASB, 2010a:A19).

If the role of a global CFfFR is determined to be an idealised meta-metamodel, then the global CFfFR should adhere to the requirements and characteristics of a meta-metamodel. The status of the CFfFR according to the IASB does not comply with the requirements of completeness and comprehensiveness, inherent coherency or logical consistency as required by the OMG four level hierarchy. The idea of the ideal CFfFR and the role of the CFfFR as a meta-metamodel answer SRQ 1 and contribute towards answering SRQ 2 (Table 8.2).

8.2.2 SRQ 1: Evaluation

According to the FEDS evaluation strategy the artefact developed during DSR Cycle 1 and the first two artefacts developed during DSR Cycle 2 served as the first three evaluation episodes on the Human Risk & Effectiveness strategy path as indicated in Figure 8.3.

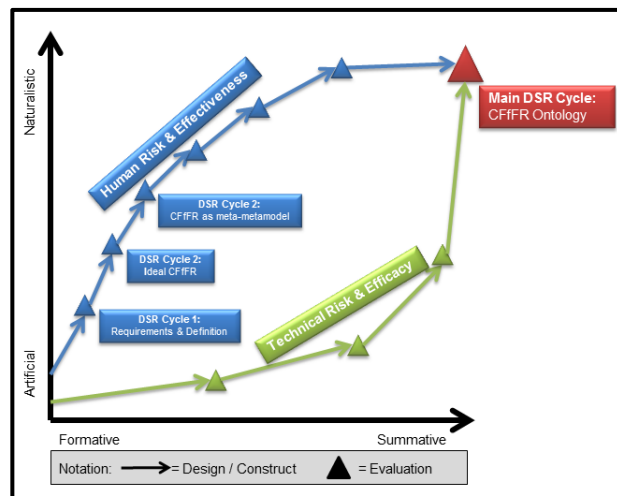


Figure 8.3: CFFFR ontology artefacts 1-3

As it was possible to determine the characteristics and perceptions as well as the content requirements for a global CFFFR (section 4.6) and formulate a definition for a global CFFFR (section 4.7) based on these requirements, it can be concluded that SRQ 1 was partially answered in Chapter 4 with the development of the artefact in DSR Cycle 1. During DSR Cycle 2, the ideal role of the CFFFR was determined to be that of a meta-metamodel within the financial reporting domain (Figure 8.3).

SRQ 1 was answered in Chapter 5 during DSR Cycle 2 when the role of global CFFFR was determined to be a meta-metamodel according to the OMG four level hierarchy.

8.3 Sub-Research Question 2 (SRQ 2)

How can model building assist to construct a global CFFFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

The second sub-research question was answered during DSR Cycle 2 and reported on in Chapter 5 (Table 8.2). The first two artefacts developed during DSR Cycle 2, the idea of an ideal CFFFR and the role of the ideal CFFFR as a meta-metamodel, had a double function and contributed towards answering SRQ 1 (section 8.2 and Table 8.2).

8.3.1 SRQ 2: Findings

During DSR Cycle 2, it was established that the ideal CFFFR has the role of a meta-metamodel within the financial reporting domain. A global CFFFR should comply with the role of an ideal CFFFR in order to adhere to the characteristics of a meta-metamodel within the OMG four level hierarchy. Applicable characteristics of the OMG four level hierarchy are that a model on a lower level in the hierarchy should conform to the concepts and relationships defined in a higher-level model. Although a higher level model functions on a higher level of abstraction, all the

concepts and relationships of the lower level model should be present in a higher-level model to ensure that it complies with the *comprehensive* requirement. If the model hierarchy adheres to the comprehensive requirement, the model structure should also be *complete*, as all the instances in the domain should be represented in the highest model in the hierarchy. If a global CFfFR functions as meta-metamodel according to the OMG model hierarchy it should comply with the complete and comprehensive content requirements as determined in section 4.6.2.

The idea of an ideal CFfFR truth-bearing model contributes towards the goal of the CFfFR to be globally acceptable as an ideal CFfFR, and serves as a benchmark against which the CFfFR can be measured. In order for the ideal CFfFR to assume the role of a truth-bearing model, the notion of intentionally false but ideal assumptions provides the vocabulary and conceptualisation to communicate regarding the end goal of the CFfFR. With the end goal in mind, it is possible to evaluate if the development of the CFfFR is progressing toward a global CFfFR. The ideal assumptions of the ideal CFfFR functions as a construct artefact and the fourth knowledge contribution on the Human Risk & Effectiveness evaluation strategy (Figure 8.4).

8.3.2 SRQ 2: Evaluation

SRQ 2 was answered by indicating how model building and the positioning of the ideal CFfFR within the role of a meta-metamodel, according to the OMG four level hierarchy (Figure 5.11 and Figure 5.12), could function as a sound foundation for accounting standards. Firstly, within the OMG four level hierarchy, the models on the different levels of the hierarchy must *conform_to* the other models for the complete system to be internally coherent and logically consistent. Secondly, in order for the model system to be sound, the model on the highest level of abstraction, the meta-metamodel, should be complete and comprehensively inclusive of the models on the lower levels and ultimately the instances in the SUS. By formulating the idealised assumptions, the ideal CFfFR serves as a truth-bearing model as it indicates how the ideal CFfFR should look like and provide an indication of where the CFfFR does not adhere to the ideal CFfFR to be globally acceptable.

The artefacts produced during DSR Cycle 2 established the knowledge that model building could assist in constructing a global CFfFR. Figure 8.4 illustrates the role of the artefacts in the Human Risk & Effectiveness FEDS framework evaluation strategy to build towards the CFfFR ontology.

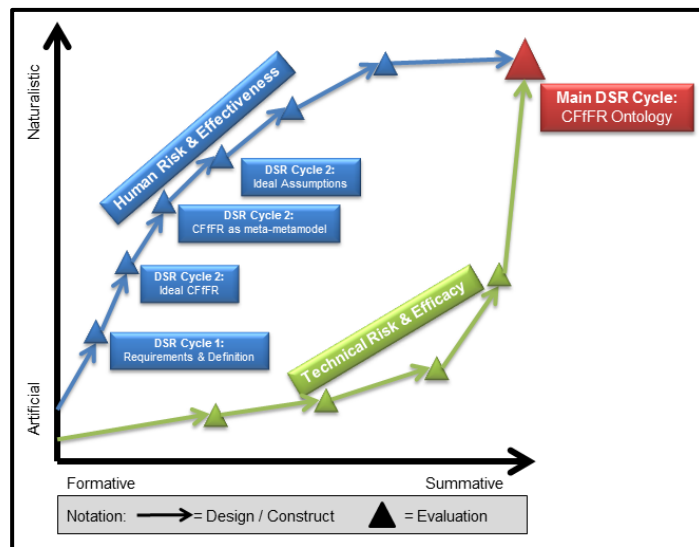


Figure 8.4: CffFR ontology artefacts 1-4

8.4 Sub-Research Question 3 (SRQ 3) and the Main RQ

How can the formalisation of the CffFR using ontologies assist to construct a CffFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

8.4.1 SRQ 3 and Main RQ: Findings

With the knowledge obtained during DSR Cycles 1 and 2, the possibilities of conceptual modeling and ontologies in computing were explored. During DSR Cycle 3, ontology in philosophy (section 6.2) was investigated to serve as background for the use of ontologies in computing (section 6.3) and the application of ontologies in the financial reporting domain (section 6.4). From the discussion on ontology in philosophy, the importance of logic and logical consistency in ontologies was determined. A finding of this study is that logical consistency is a pre-requisite for cross-cultural acceptance of theories (section 6.2.3). This finding supports and emphasises the content requirement for a global CffFR determined during DSR Cycle 1, that a global CffFR should be *logically consistent* (section 4.6.2e) to achieve scientific credibility in an accounting community.

The use of formal languages (Figure 6.5) based on formal logic was adopted by computing in order to build logically consistent models (section 6.2.2). This provided the opportunity to explore the possibility that, if it is possible to build a formal ontology of the CffFR, it would assist in building a CffFR ontology that is logically consistent which would contribute towards answering SRQ 3.

The applicability of conceptual modeling, as used in computing, on the financial reporting domain was argued in section 6.3.2a). Once the applicability of conceptual modeling was established, the possible benefits of the CffFR as digital domain was determined (section 6.3.2b)). An investigation into the relationship between

ontologies, models and metamodels (section 6.3.2c)) resulted in the finding that the CFfFR functions in the financial reporting domain with the purpose of providing guidelines for the development of accounting standards that are principally based, internally consistent and internationally converged.

DSR Cycles 1, 2 and 3 provided the theoretical foundation and motivation to use ontology technologies to answer SRQ 3 and together with that the main research question.

In DSR Cycle 4, the development of the formal domain ontology of the CFfFR was done in two versions, through four Iterations. The CFfFR ontology was developed according to the guidelines of the OLC Model (section 7.2). At the start of Iteration 1, certain assumptions were adopted to build a formal domain ontology of the CFfFR (section 7.2). One of the assumptions was that the CFfFR would be the main source of information and that if the meaning of something is not clear from the natural text of the CFfFR, it is an indication of an ambiguity or an unintended meaning. Based on this assumption, some unintended meanings were indicated during the formalisation process.

Another assumption was that the CFfFR should encapsulate all of the most basic definitions and principles (postulates) to be included in the CFfFR ontology in order to comply with the competency question: to formalise the classes and relationships that could provide decision-useful information to the users of financial reports. This assumption could not be maintained and additional information not included in the CFfFR (i.e. financial reports and DP/2013/1) was required to build a CFfFR ontology. This is an indication that the CFfFR does not encapsulate all of the most basic definitions and principles (postulates) necessary to provide decision-useful information to the users of financial reports. Some of the additional information required was identified as implied domain knowledge not communicated explicitly in the CFfFR.

Implied domain knowledge was experienced to be a major problem in building the CFfFR ontology. The following were identified as some of the most important implied domain knowledge not provided, but crucial to building the CFfFR ontology:

- An important concept not addressed in the CFfFR is the functioning of the notion of time in financial reporting. The value and function of the notion of time are assumed as domain knowledge and not discussed explicitly. An explicit explanation of the use of the notion of time is provided in section 7.2.3. This problem was solved by creating the classes `TemporalInstance` and `TemporalInterval` with its related sub-classes.
- Another basic class assumed as domain knowledge is the reporting class. The reporting class is dealt with in detail in IAS 1, but the basic principles of the reporting class should be included in the CFfFR to comply with the completeness and comprehensive content requirement of a global CFfFR.

- It is never explicitly stated in the definitions of the elements of financial statements that it is monetary values that are reported on in financial statements. The modeling decision was made to create the class `Value` to be able to model this implied domain knowledge.
- Related to the implied domain knowledge of the class `Value` is the lack of clarity on how a value is attached to an economic activity or instance. The implied domain knowledge on how and when economic activities are measured was made explicit by developing a decision filter process. The decision filter process is schematically presented in Figure 7.19. Based on the decision filter process and a detailed analysis of the CFfFR in Iteration 4, a main class called `EconomicMeasurementClass` was created to formalise the notion of measurement in the financial reporting domain (section 7.6.3b)).
- Another basic concept essential to formally represent the CFfFR but not explicitly explained in the CFfFR is that decision-useful information is reported in a financial report consisting of financial statements, notes to these financial statements and other information. In order to formalise this implied knowledge, a class called `ReportingClass` was created (section 7.6.3d)). The terms financial reports and financial statements are used in the CFfFR without distinguishing between the two terms.
- More implied domain knowledge was identified when the definitions of the elements of financial reports were formalised and is reported during the four iterations.

Some inconsistencies in the CFfFR were identified. The most important inconsistencies were found in the definitions of liability (sections 7.3.3 and 7.4.3), equity (section 7.3.4) and income and expense. The inconsistencies detected in the definitions of income and expense was of such a nature that these definitions could not be modelled without inconsistencies (section 7.6.3c)).

Numerous unintended meanings in the natural text were detected and modeling decisions were made to enable a formalisation of these classes and relationships.

Although it was not the intention at the beginning of the study to indicate incompleteness in the CFfFR some incomplete concepts were detected. Some of these incomplete aspects are acknowledged by the IASB and are in the process of being developed. The known incomplete concepts were identified as reporting entity, valuation and measurement criteria and disclosure requirements. These concepts are currently being developed by the IASB.

One of the biggest challenges experienced in the attempt to formally represent the most basic classes and relationships that would provide decision-useful information to the intended users of financial reports, was to decide what information provided in the CFfFR must be formalised as classes and relationships in the ontology and what information informs the ontology by way of competency questions. After an unsuccessful attempt to formally represent the CFfFR document in Iteration 3, a new

strategy was adopted in Iteration 4. In Iteration 4, the CFfFR was analysed (Appendix D – CFfFR working document and Appendix E – Ontology engineering decisions) using the decision process filter (section 7.5.2, Figure 7.19) to determine what information should be included in the formal domain ontology of the CFfFR and what information forms part of the competency questions (sections 7.6.1, 7.6.2 and 7.6.3a)). The results of the analysis are schematically illustrated in Figure 7.21.

Based on the analysis and information obtained during Iterations 1, 2 and 3 a formal representation of the most basic classes and relationships that would provide decision-useful information was done in Protégé using OWL and is presented as a second version of a CFfFR ontology (Figure 7.30). The CFfFR ontology was tested for logical consistency using the reasoner FaCT++. According to the reasoner, the CFfFR ontology is internally coherent and logically consistent.

8.4.2 SRQ 3: Evaluation

By adopting the ideal assumptions of the ideal CFfFR and building a CFfFR ontology it was indicated how the use of ontology technologies could assist in constructing a globally acceptable CFfFR as the CFfFR ontology complies with more requirements of a global CFfFR than the CFfFR. During the building process, deficiencies in the CFfFR related to the ideal CFfFR were indicated. The CFfFR ontology can therefore be viewed as a truth-bearing model. The CFfFR ontology indicates that it is possible to construct a global CFfFR by identifying inconsistencies and unintended meanings in the CFfFR. Figure 8.5 illustrates the Technical Risk & Efficacy evaluation strategy followed in building the CFfFR ontology.

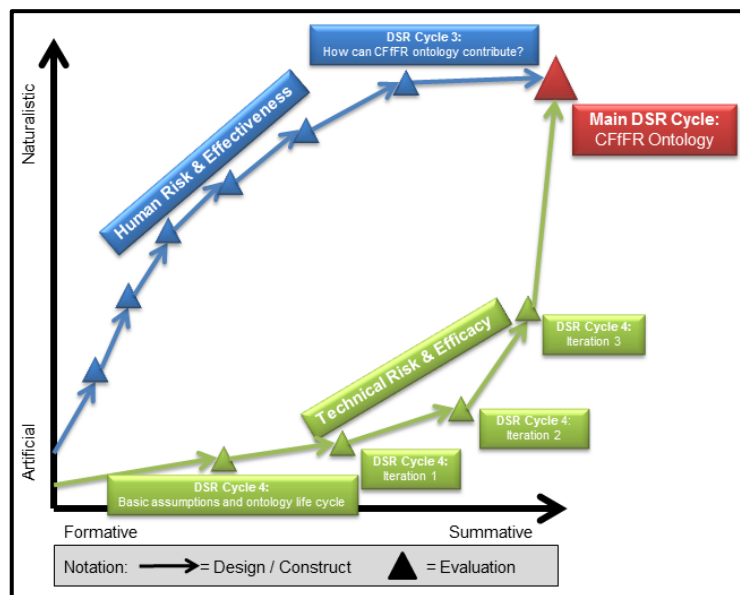


Figure 8.5: CFfFR ontology Technical Risk & Efficacy artefacts

The artefacts developed during DSR Cycle 4 were developed to substantiate the decisions made while building the CFfFR ontology. The following artefacts were published via peer reviewed processes, providing an indication of the acceptability of these artefacts:

- DSR Cycle 4: The basic assumptions and OLC (Gerber et al., 2014);

- DSR Cycle 4: Iteration 1, modeling time and modeling the definitions of asset, liability and equity (Gerber, Gerber, Van der Merwe, et al., 2015);
- DSR Cycle 4: Iteration 2, Identification of basic classes and relationship in SFP element definitions (Gerber, Gerber, Van der Merwe, et al., 2015);
- DSR Cycle 4: Iteration 3, Decision process model (Gerber, Gerber, & Van der Merwe, 2015).

The final evaluation episode was when the CFfFR ontology was built during Iteration 4. The CFfFR ontology, by being internally coherent, logically consistent and more complete, complies with more requirements of an ideal CFfFR than the CFfFR. It can be concluded that the main research question was answered by demonstrating how a CFfFR consisting of logically formalised fundamental concepts can be developed. This CFfFR ontology can serve as a meta-metamodel within the ontology hierarchy of financial reporting (Figure 6.6). In its role as metamodel, the CFfFR ontology can function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged. By building the CFfFR in two versions through four iterations, it was indicated where the natural texts of the CFfFR does not comply with the content requirements of a global CFfFR thus making the CFfFR ontology a truth-bearing model. By building the second version of a CFfFR ontology, SRQ 3 and the main research questions were answered as the formal domain ontology of the CFfFR is principle-based, the classes and relationships are the principles, and it is internally consistent as it was tested for internal and logical consistency with the reasoner. The CFfFR ontology provides a method and information towards a global CFfFR that can be internationally converged.

CHAPTER 9

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9 CONTRIBUTION

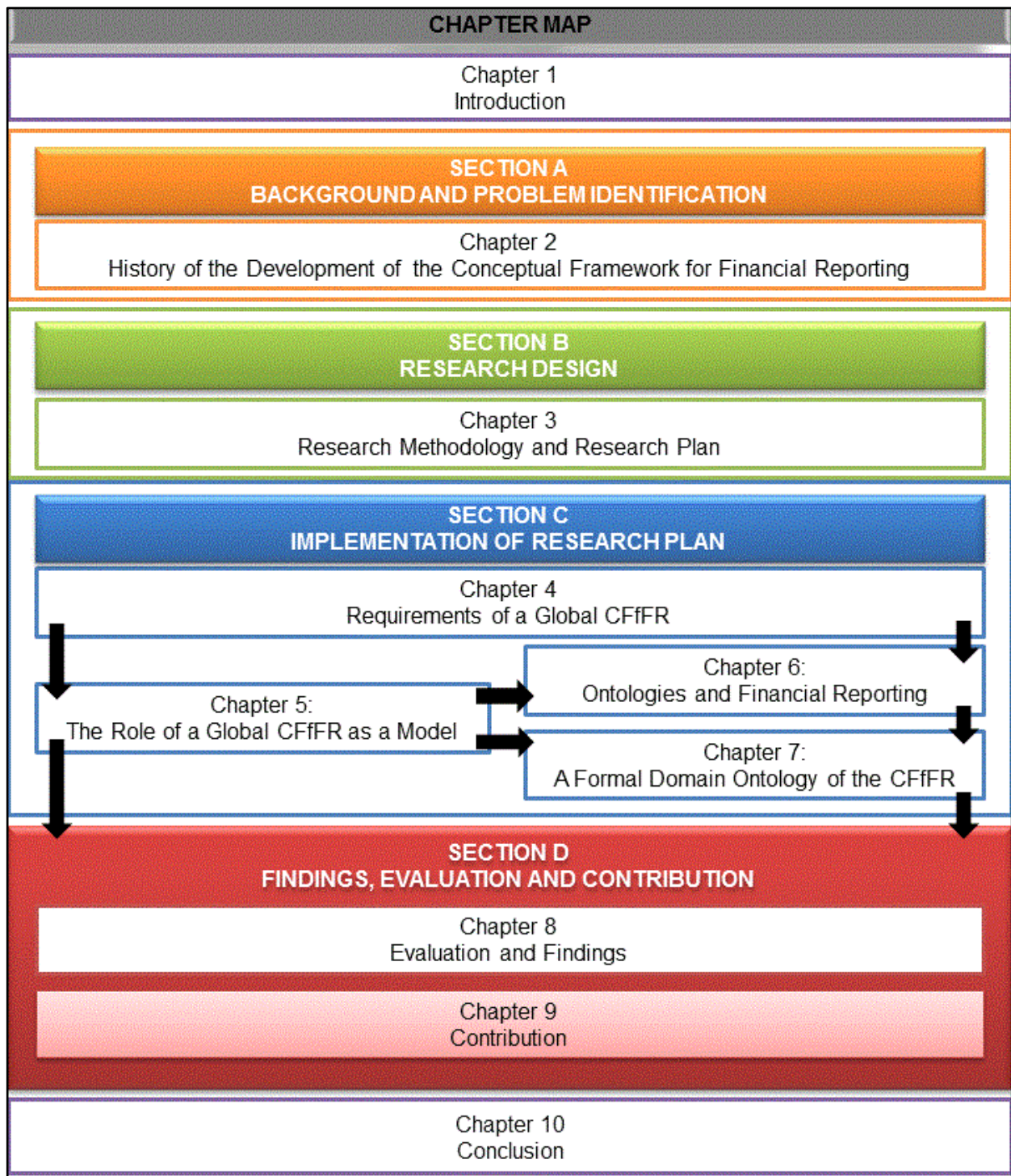


Figure 9.1: Chapter map: Chapter 9

9.1 Introduction

The research problem identified during the literature review is that since the first academic publication on accounting by Luca Pacioli entitled *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* in 1494, the accounting community have been searching for a conceptual framework for financial reporting that is globally accepted. In this study, some suggestions are made on how a global CFfFR can be created. In Chapter 9, the research contributions made during the execution of the DSR strategy are discussed. The aim of the study is to communicate the usefulness of the newly generated knowledge regarding the drafting of a global CFfFR.

One of the guidelines for studies using the DSR approach is that such a study should produce clear and verifiable contributions in the areas of the designed artefact (Hevner et al., 2004).

In this study, the contributions towards solving the research problem are embedded in the multi-disciplinary DSR approach. The study takes advantage of theories in philosophy (ontology), philosophy of science (idealised models) and computing (conceptual modeling, OMG model hierarchy and ontologies) to generate new knowledge related to the CFfFR ontology artefact. Recent advances in ontology technologies utilised in the computing discipline served as a stimulus to embark on the research project in search of a possible solution for the research problem.

During the DSR strategy, twelve artefacts were developed and were presented as knowledge contributions during the four DSR Cycles. The role of these artefacts in answering the research questions were discussed in Chapter 8 and is illustrated in Table 9.1.

Table 9.1: Summary of artefacts contributing towards answering the research questions in the DSR Cycles

	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
ARTEFACT	Development Step moves to DSR Cycle 1.	Construct: Requirements & Definition of a global CFfFR. (Sections 4.6 and 4.7)	Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4). Construct: Idea of an ideal CFfFR as truth-bearing model (section 5.2.4).	Model: The role of the ideal CFfFR as a formal domain ontology according to OMG four level hierarchy (section 6.4).	Construct: <ul style="list-style-type: none"> Basic assumptions to build a formal domain ontology of the CFfFR (section 7.2.2). Use of OLC in financial reporting domain (section 7.2).
			Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5). Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5).	Construct: Conceptualisation on how CFfFR ontology could contribute towards the research questions (section 6.4.3).	Model: Iteration 1 (section 7.3): <ul style="list-style-type: none"> Modeling of time. Modeling definitions of asset, liability and equity.
			Construct: Ideal assumptions provide vocabulary and conceptualisation to communicate regarding ideal and possible global CFfFR (section 5.4).		Model: Iteration 2 (section 7.4): <ul style="list-style-type: none"> Identification of basic classes and relationships in SFP element definitions. Proposed SFP element definitions, which are logically consistent.
	Model: The CFfFR ontology indicating internal incoherence's, logical inconsistencies, implied knowledge and incompleteness of CFfFR (sections 7.4, 7.5 and 7.6).				Model: Iteration 3 (section 7.5): <ul style="list-style-type: none"> Identification of key classes and relationships in the CFfFR ontology. Decision process model.
					Model: Iteration 4 (section 7.6): Building the CFfFR ontology.
	Main RQ	SRQ 1	SRQ 1 SRQ 2	SRQ 3	SRQ 3 Main RQ

Although the contributions of the study are linked to the artefacts as discussed in Chapter 8, the contributions are not only contained to the artefacts. The contributions of the study are also linked to the findings made during the building process of the CFfFR ontology. In Chapter 9, the contributions of the study towards addressing the research problem are described from the following perspectives:

- a methodological perspective;
- a technological perspective,
- an interdisciplinary perspective and,
- an accounting perspective.

Although the last artefact produced, the CFfFR ontology was also noted under the findings perspective the value of the contribution justifies that it is discussed separately. Table 9.2 summarises the contributions under the different perspectives.

Table 9.2: Summary of contributions

		Perspectives			
		Methodological	Technological	Interdisciplinary	Accounting
Contributions	DSR as research method: <ul style="list-style-type: none"> The successful use of the DSR approach in financial accounting. The use of DSR broadens the research possibilities in financial accounting. Using DSR in financial reporting in a study where the outcome of the study is not clear at the outset. Using DSR in financial reporting on the CFfFR producing 11 knowledge contribution artefacts (Table 9.1). 	Ontology technologies: <ul style="list-style-type: none"> The use and application of Protégé, OWL and FACT++ as ontology technologies on the CFfFR creating the possibility of digital and computer readable accounting standards. 	Models as isolations by idealisation and truth containers: <ul style="list-style-type: none"> The formulation of untrue idealised assumptions contributes towards determining how a global CFfFR can be constructed. The notion of an ideal CFfFR as truth container regarding the reality of financial reporting contributes towards the method how it is possible to gain knowledge of reality by isolating a research object in financial reporting. 	Requirements and definition for a global CFfFR. Content Requirements: <ul style="list-style-type: none"> Complete and Comprehensive; Internally Coherent; Clear and Unambiguous; Logically Consistent. Definition of a global CFfFR: <ul style="list-style-type: none"> A conceptual framework for financial reporting is an internally coherent and logically consistent representation of fundamental concepts that unambiguously prescribes the nature, function and limits of financial reporting. 	
	Ontology Life Cycle Model: <ul style="list-style-type: none"> The application of the OLC Model as research technique in financial accounting combined with ontology technologies to add rigour to the research process. The use of the OLC Model broadens the research possibilities in financial accounting. 		Models in computing: Viewing the financial reporting domain from a model perspective contributes towards: <ul style="list-style-type: none"> communication between developers and users; analysing and understanding the financial reporting domain; provide input in the design process; document requirements for future use. Contribution of type and token models and the characteristics requirements of conceptual models in computing to determine the role of a global CFfFR as a meta-metamodel. 	The ideal meta-metamodel role of the global CFfFR. <ul style="list-style-type: none"> The ideal meta-metamodel role contributes towards understanding the role of a global CFfFR within the financial reporting hierarchy. The importance of coherence between the CFfFR and accounting standards within the financial reporting hierarchy was illustrated. 	
	Testing concepts / (classes) and their relationships in a natural text: <ul style="list-style-type: none"> The combined use of DSR and the OLC Model provide a theoretical substantiation and rigorous method to test and formalise classes and 		From ontology in philosophy: <ul style="list-style-type: none"> Value of the use of a formal language to represent the CFfFR; The importance of logical consistency as requirement for a global CFfFR. 	The formal domain CFfFR ontology. <ul style="list-style-type: none"> The CFfFR ontology can fulfil the role of a meta-metamodel in the financial reporting ontology hierarchy. The CFfFR ontology is closer to 	

Perspectives				
	Methodological	Technological	Interdisciplinary	Accounting
	their relationships communicated in a natural text.			an ideal CFfFR than the CFfFR as it complies to more of the requirements of a global CFfFR.
			Ontologies in computing: <ul style="list-style-type: none"> • Use of the OMG model hierarchy to illustrate the relationships in the financial reporting domain. • The creation of the decision process filter to illustrate how accountants determine what, when and how economic activities are reported. • Analysis of the CFfFR to distinguish between competency questions and classes and relationships included in the CFfFR ontology. 	The results from building the CFfFR ontology for the CFfFR identifying: <ul style="list-style-type: none"> • logical inconsistencies; • unintended meanings; • implied domain knowledge and; • incompleteness of the CFfFR.
			The formal domain CFfFR ontology artefact and the findings related to building the artefact. The artefact was constructed by analysing a natural text representing accepted domain knowledge.	

9.2 Methodological Perspective

The nature of the research project being an interdisciplinary project combining accounting, computing and philosophy resulted in different methods being used to answer the research questions. The challenge was to combine the methods under one research strategy. From a methodological perspective, the use of DSR and the OLC Model are novelties in research approach and research techniques utilised in financial accounting. The use of ontology technologies to analyse and test concepts (classes) and their relationships as it is communicated in a natural text from financial reporting provide rigour to the analysis process not previously used in financial reporting.

9.2.1 Design Science Research

In computing and engineering, a Design Science Research (DSR) approach is used when the purpose of the study is to build an artefact, but the process and exact outcome of the artefact is not clear at the outset of the study. A DSR approach allows the researcher to use various research methods and accumulate knowledge during the different cycles of the research project. Every research cycle builds on the knowledge gained during a previous DSR Cycle (Figure 3.2).

The purpose of this study was to build an artefact, an ontology of the CFfFR to determine how and if it is possible to progress towards a global CFfFR. At the outset of the study, the process and exact structure or outcome of the artefact was vague. As the process and the outcome of the research project was unknown, a research approach was necessary to accommodate the stated uncertainties. With the study being an interdisciplinary study it was determined that, in circumstances similar to this study, a DSR approach is used in computing. By adopting a DSR approach, it was possible to accumulate knowledge using different research techniques in a structured manner applied to different disciplines in order to reach the result - a CFfFR ontology artefact.

At the time of this study no evidence of the use of a DSR approach in financial accounting could be found. The contribution from a methodological perspective is that in this study it was demonstrated that a DSR approach could be used in financial accounting projects where the research process and research outcome is uncertain at the start of the research project. The goal was to develop an artefact for a wicked problem, in this case an investigation on how ontologies can contribute to solve the wicked problem on how to construct a global CFfFR was conducted.

9.2.2 Ontology Life Cycle Model Applied to Accounting

The research technique used in DSR Cycle 4 to build the CFfFR ontology was adopted and adapted from the OLC Model developed by Neuhaus et al. (2013) during the 2013 Ontology Summit to develop and evaluate ontologies. The OLC Model was chosen (section 3.8.3) to ensure that the CFfFR ontology would conform to international requirements of an ontology.

Although not all the cycles in the OLC Model were completed, the guidelines provided ensured that the building process was rigorously performed. As was the case with the adoption of the DSR approach, the adoption of the OLC Model from computing in an accounting study proved to broaden the research possibilities in accounting. Apart from using the OLC Model in a financial accounting study, it is also not common to build an ontology in computing using a natural written text as a domain reality. The contribution from a methodological perspective is that the method has not previously been applied in the accounting discipline to build a model of an accounting concept. The successful use of the OLC Model to build a CFfFR ontology suggest the possibility to use the model to build ontologies of accounting standards.

9.2.3 Method to Test Concepts / (Classes) and Relationships in a Natural Text

The main research question was defined as: “*How can a CFfFR consisting of logically formalised fundamental concepts be developed?*” The method used in this study was initially motivated from a theoretical perspective before it was applied on the CFfFR. The building of the CFfFR ontology was theoretically substantiated by referencing the use of model theories in philosophy of science and computing. The theoretical substantiation to use ontology technologies was motivated by indicting the applicability of model and ontology theories on the financial reporting domain.

The contribution made by this study is that the DSR research approach and OLC Model used in this study both provide a theoretical substantiation and a rigorous method to build an artefact from a natural text that logically formalise the fundamental classes and relationships of a specific domain. Based on this contribution, it should be possible to use this method to analyse financial accounting standards.

9.3 Technological Perspective

From a technological perspective, the contribution is related to the use of ontology technologies. The technology used in this dissertation is a recent development and used to formally represent specified domains. Ontology technologies are used in artificial intelligence, enabling computers a certain level of intelligent reasoning (section 3.8.3). Following the stimulus/response system used to describe the historical development of the CFfFR in Chapter 2, the use of ontology technologies such as Protégé could become a technological stimulus towards computer readable financial accounting standards.

The contribution from this study is that the use of ontology technologies to build the CFfFR ontology artefact indicated that it might be possible to digitise financial accounting standards into a computer readable format.

9.4 Interdisciplinary Perspective

The interdisciplinary approach followed to utilise established knowledge from other disciplines provided the possibility to endeavour on a research path not possible if the research approaches and methods were limited to a traditional accounting research paradigm. In sections 9.4.1, 9.4.2, 9.4.3 and 9.4.4 the knowledge contributions from the different disciplines are discussed.

9.4.1 Models as Isolation by Idealisation and Truth Containers

From philosophy of science the knowledge was adopted that an idealised model based on untrue idealised assumptions (a model isolated by idealisation, section 5.2.1) can be a truth container (section 5.2.3) regarding reality. This knowledge contributed towards the theoretical motivation that a CFfFR ontology based on idealised assumptions (sections 5.4 and 6.5) could bear some truth regarding the method and possibility to create a global CFfFR (section 5.2.4, Figure 5.5 and Figure 5.6).

The contribution by this study is that it is possible to gain knowledge of reality (the financial reporting domain) by isolating a research object (the CFfFR) by adopting untrue and idealised assumptions regarding the phenomenon under investigation.

9.4.2 Models in Computing

The knowledge contributions obtained from the use of models in computing for this study consist in that it allows the researcher to investigate the financial reporting reality (a SUS) on an abstract level (section 5.3.2). The usage of conceptual models in computing to represent static phenomena (classes and their relationships) and dynamic phenomena (events and processes) were adopted when building the CFfFR ontology. In computing, models are also used as graphical representations to simplify and standardise complex realities (SUSs). The following four purposes of conceptual models in computing (Wand & Weber, 2002) was adopted and applied in this study:

- (1) *Communication between developers and users.* The CFfFR ontology model and other models developed in this study can be used for communication between standard setters, users of financial reports and other interested parties.
- (2) *Assist analysts to understand the domain.* The following conceptual models were developed in this study and contribute towards the understanding and communication of the financial reporting domain:
 - Figure 4.6: Requirements of a conceptual framework
 - Figure 5.5: Model formula of the CFfFR
 - Figure 5.6: Model formula of the formal domain ontology
 - Figure 5.8: Financial reporting token, type model relationship including financial accounting standards
 - Figure 5.10: OMG four level hierarchy combined with financial reporting token and type model relationships
 - Figure 5.11: CFfFR as meta-metamodel in the four level hierarchy
 - Figure 5.12: OMG four level hierarchy applied to financial reporting models
 - Figure 6.6: Ontology, OMG and model hierarchy of the financial reporting domain
 - Figure 7.6: `TemporalClass is_a` relationships
 - Figure 7.7: Formal representation of `Asset`
 - Figure 7.8: Relationship between `Resource` and `Asset`
 - Figure 7.9: Formal representation of liability
 - Figure 7.10: Inconsistency in equity definition

- Figure 7.11: Formal representation of equity
- Figure 7.13: Basic classes and relationships of the SFP elements
- Figure 7.14: Proposed asset definition
- Figure 7.15: Proposed liability definition
- Figure 7.16: Proposed equity definition
- Figure 7.19: Decision process to report decision-useful information
- Figure 7.21: CFfFR ontology
- Figure 7.22: Economic Measurement Class: *is_a* relationships
- Figure 7.26: Reporting Class: *is_a* relationships
- Figure 7.27: Temporal Class: *is_a* relationships
- Figure 7.28: CFfFR ontology – Version 2 *is_a* relationships
- Figure 7.30: CFfFR Version 2 – all relationships

(3) *Provide input in the design process.* The models developed and indicated above were all used to provide input in the design process of the CFfFR ontology (Figure 7.21 and Figure 7.30) thus contributing towards understanding how a global CFfFR can be constructed.

(4) *Document requirements for future reference.* The requirements and role for a CFfFR ontology was documented in Chapters 4, 5, 6 and 7 using graphic models. The graphic models are listed under number (2) above. The process to build the ontology is documented in Appendix D – CFfFR working document and Appendix E – Ontology engineering decisions. The work documented may contribute towards future discussions regarding the construction of a global CFfFR ontology.

The theory (type and token models), characteristics (abstraction of a System Under Study (SUS)) and requirements (complete representation on an abstract level) of conceptual models in computing contributed towards the understanding of the requirements (Chapter 4, Figure 4.6) and role of a global CFfFR as a meta-metamodel in the financial reporting hierarchy (Chapter 5, Figure 5.5 and Figure 5.12).

The contribution from studying the use of models in computing is that the financial reporting domain can be viewed from a model perspective. From a model perspective, the requirements and role of the CFfFR within the financial reporting domain were confirmed and demonstrated. If the role of CFfFR is viewed as a meta-metamodel, the role of the CFfFR differs from the status assigned to the CFfFR by the IASB and FASB.

9.4.3 Ontology in Philosophy: Formal Language and Logical Consistency

The contributions to the study obtained from ontology in philosophy are (1) the value of the use of a formal language to represent the CFfFR and (2) the importance of the requirement that a global CFfFR should be logically consistent.

Although the discipline related to ontology in philosophy is an ancient discipline (starting with Aristotle) and well known and applied in accounting research, some

valuable knowledge was adopted in this study. From ontology, the notion of a formal language and the advantages of presenting a knowledge domain in a formal language was adopted via its use in ontology technologies. An essential requirement, i.e. logical consistency for the acceptance of a global CFfFR, was derived and confirmed from the use of logic in ontologies. In philosophy, it is argued that logical consistency of a theory is a pre-requisite for cross-cultural acceptance of that theory (section 6.2.3). One of the requirements determined for a global CFfFR is that it should be logically consistent (section 4.8.4).

9.4.4 Ontologies in Computing

The contributions from ontologies in computing can be summarised as follows:

- The use of the OMG model hierarchy to illustrate the relationships of a financial reporting domain ontology (Figure 6.6). The combination of the ontology hierarchy of the financial reporting domain, the model hierarchy of the financial reporting domain and the OMG model hierarchy provides a high-level conceptual understanding of the use of ontologies and models in the financial reporting domain.
- The creation of the decision process filter model illustrating how accountants go about determining what, when and how economic activities of a reporting entity should be reported in a financial report (Figure 7.19).
- The analysis of the CFfFR to determine what information should be included in the CFfFR ontology and what information serves an informative purpose (Figure 7.21).

The main contributions of the study are the formal domain CFfFR ontology artefact (Figure 7.21 and Figure 7.30) and the findings (Chapter 8) related to building the formal domain CFfFR ontology. In Chapter 8, the findings are presented. The discussion findings indicate how the research problem and research questions were addressed.

9.5 Accounting Perspective

From an accounting perspective the following contributions indicated in sections 9.5.1, 9.5.2, 9.5.3 and 9.5.4 can be viewed as contributions towards financial accounting and more specifically the financial reporting domain in accounting.

9.5.1 Requirements and Definition for a Global CFfFR

During DSR Cycle 1 (Chapter 4), the requirements and a definition for a global CFfFR were identified. The requirements contribute towards the body of knowledge by combining the requirements known in the field into one conceptual model. These requirements were used in the study to test the global acceptability of the CFfFR and should, if the CFfFR complies with these requirements, contribute towards building a CFfFR that is more acceptable in the international community.

9.5.2 The Ideal Meta-metamodel Role of a Global CFfFR

The role of the ideal CFfFR as a meta-metamodel determined during DSR Cycle 2 (Chapter 5) contributes towards the understanding of what the role of a global CFfFR should be. The model hierarchy stressed the importance of coherence between the CFfFR and accounting standards as model in order for the CFfFR to be globally acceptable. The implication is that the current status of the CFfFR should be reconsidered to be closer to the ideal role of global CFfFR for the CFfFR to be more acceptable in the international community.

9.5.3 The CFfFR Ontology

The role of the CFfFR ontology was determined to be that of a metamodel during DSR Cycle 3 (Chapter 6) according to the OMG four level hierarchy. The contribution is that it is clear that a CFfFR ontology, by having the role of a metamodel, is closer to the ideal CFfFR than the CFfFR itself. By building a logically consistent CFfFR ontology during DSR Cycle 4 (Chapter 7) it was indicated how it is possible to get closer to the ideal CFfFR that would be globally acceptable.

9.5.4 Identification of Logical Inconsistencies, Unintended Meanings, Implied Domain Knowledge and Incompleteness of the CFfFR

Some logical inconsistencies, unintended meanings, implied domain knowledge and incomplete concepts were identified during the building process of the CFfFR in DSR Cycle 4 (Chapter 7). These findings were reported in Chapter 8 and can now be considered by the accounting community to improve the CFfFR. Although the accounting community already knew some of the findings reported before they were highlighted in this study, these findings are now the result of a structured and well-motivated process supported by technologies developed to detect logical technologies, unintended meanings, implied domain knowledge and incompleteness in a specified domain.

9.6 Conclusion

In Chapter 9, an overview of the knowledge generated through using the DSR approach was presented. It was argued that the newly generated knowledge contributes towards solving the research problem and related research questions. These contributions extend the knowledge on the requirements, role and problems with providing a global CFfFR.

The main contribution of the study is the creation of a CFfFR artefact. The artefact demonstrates that it is possible to get closer to the ideal CFfFR that could be globally acceptable. The findings reported on the problems experienced during the process of building the CFfFR ontology contributes towards adjustments that could be considered when revising the CFfFR.

The contributions of knowledge obtained from the different disciplines consulted in this study were also discussed. These contributions include the use of a model theory from philosophy of science, the use of a formal language and confirmation of importance of the logical consistency requirement from philosophy and the conceptual demonstration of the hierarchy and role of accounting models and the hierarchy of accounting ontologies.

Chapter 10 concludes the report on this research project by providing an overview of this study.

CHAPTER 10

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10 CONCLUSION

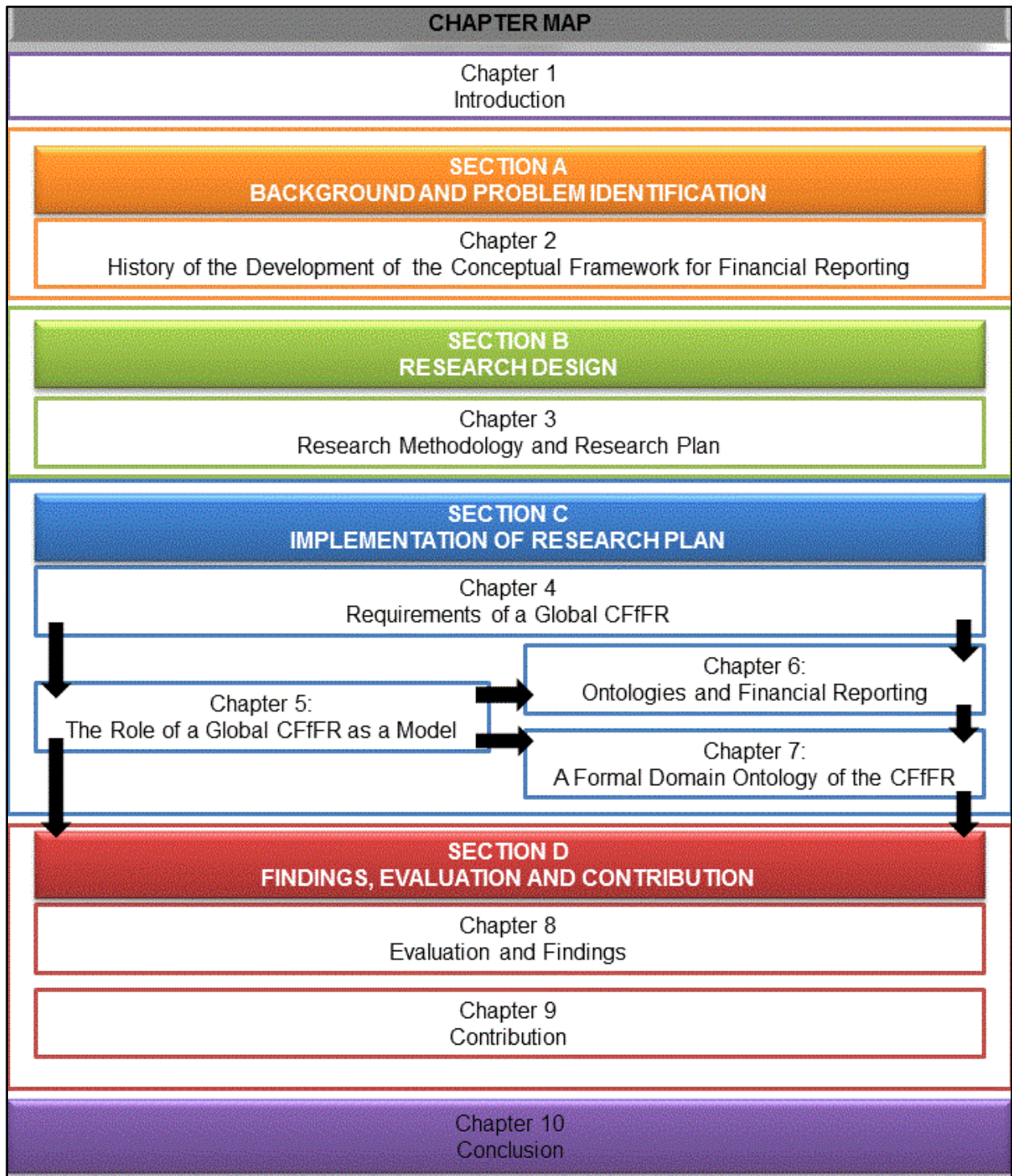


Figure 10.1: Chapter map: Chapter 10

10.1 Introduction

The purpose of Chapter 10 is to provide a conclusion to the study. Section 10.2 summarises the problem, motivation and scope of the study. Section 10.3 presents a summary of the findings of the study, structured according to the research design answering the research questions. Section 10.4 presents a reflection on the research project followed with a discussion on the limitations of the study in section 10.5. Areas for further research are suggested in section 10.6.

10.2 Problem Identification, Motivation and Scope

The CFfFR developed during the ages through an evolutionary process of stimulus and response (Salvary, 1979). Investors in an intertwined global economy require one set of clear, high-quality, principles-based accounting standards that is used globally (Zeff et al., 2013; Zeff, 2012). The SEC confirms this need for a single set of globally-recognised accounting standards (Stein, 2015). Although this need was already formally voiced in 1957 (Kraayenhof, 1960), the accounting community is still in need of a single set of globally-recognised accounting standards (Bullen & Crook, 2005; Barth, 2006; Barth, 2013b).

In order to meet the need for a single set of globally-recognised accounting standards a common frame of reference guiding the setting of accounting standards is required (Barth, 2008; Barth, 2013a; IASB, 2010a; Whittington, 2008b). The search for a globally-recognised CFfFR became an official project between the IASB and the FASB with the signing of the Norwalk Agreement (FASB and IASB, 2002). The ideal of a global CFfFR had not been achieved at the time this study was conducted. The CFfFR is currently under revision by both the FASB and IASB (Bullen & Crook, 2005; IASB, 2012a). The purpose of this study was to investigate how a formal representation of the classes and relationships of the financial reporting domain as documented in the CFfFR can assist in developing a CFfFR that is globally recognised.

The research problem was solved by answering the main and three sub-research questions formulated in section 3.2 around the research problem.

The **main research question** answered in this study is formulated as follows:

How can a CFfFR consisting of logically formalised fundamental concepts be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

The main research question is answered by posing three sub-research questions. The three sub-research questions are:

- **Sub-research question 1 (SRQ1):** What are the role, definition and requirements of a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research question 2 (SRQ 2):** How can model building assist to construct a global CFfFR consisting of fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?
- **Sub-research question 3 (SRQ 3):** How can the formalisation of the CFfFR using ontologies assist to construct a CFfFR consisting of logically formalised fundamental concepts, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged?

Table 8.2 provides a summary of how the artefacts developed during the four DSR Cycles contributed towards answering these research questions:

Table 10.1 Summary of artefacts contributing towards answering the research questions in the DSR Cycles

	MAIN DSR CYCLE	DSR CYCLE 1 Chapter 4	DSR CYCLE 2 Chapter 5	DSR CYCLE 3 Chapter 6	DSR CYCLE 4 Chapter 7
ARTEFACT	Development Step moves to DSR Cycle 1.	Construct: Requirements & Definition of a global CFfFR. (Sections 4.6 and 4.7)	Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4). Construct: Idea of an ideal CFfFR as truth bearing model (section 5.2.4).	Model: The role of the ideal CFfFR as a formal domain ontology according to OMG four level hierarchy (section 6.4.).	Construct: <ul style="list-style-type: none"> Basic assumptions to build a formal domain ontology of the CFfFR (section 7.2.2). Use of OLC in financial reporting domain (section 7.2)
			Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5). Model: Role of the ideal CFfFR as a meta-metamodel (type and token models of financial reporting domain) (section 5.3.5).	Construct: Conceptualisation on how a CFfFR ontology could contribute towards the research questions (section 6.4.3.).	Model: Iteration 1 (section 7.3): <ul style="list-style-type: none"> Modeling of time. Modeling definitions of asset, liability and equity.
	Model: The CFfFR ontology indicating internal incoherence's, logical inconsistencies, implied knowledge and incompleteness of CFfFR (sections 7.4, 7.5 and 7.6).		Construct: Ideal assumptions provide vocabulary and conceptualisation to communicate regarding ideal and possible global CFfFR (section 5.4).		Model: Iteration 2 (section 7.4): <ul style="list-style-type: none"> Identification of basic classes and relationships in SFP element definitions. Proposed SFP element definitions, which are logically consistent.
					Model: Iteration 3 (section 7.5): <ul style="list-style-type: none"> Identification of key classes and relationships in the CFfFR ontology. Decision process model.
					Model: Iteration 4 (section 7.6): Building the CFfFR ontology.
	Main RQ	SRQ 1	SRQ 1 SRQ 2	SRQ 3	SRQ 3 Main RQ

10.3 Summary of Findings

10.3.1 Research Design

The research project was designed to determine if the development of a formal domain ontology of the CFfFR could assist in developing a global CFfFR. As the process to develop a formal domain ontology from a natural text or outcome of the project were not certain, the DSR research strategy was adopted because a DSR strategy provides for adjustments to the research process based on knowledge acquired during the execution of a research cycle. The use of a DSR strategy in an accounting research project was an experiment in its own right. No evidence could be found that a DSR strategy had been used in accounting before and it was uncertain at the outset of the project if the DSR strategy would provide the desired results. Figure 3.3 presents a schematic illustration of the four DSR Cycles performed.

This research strategy proved to fit the research process because the knowledge gained in one cycle informed the following cycle, all contributing to the ability to answer the main research question with the completion of the last research cycle.

The results and contributions of this study indicate that a DSR strategy can be applied successfully in an accounting study.

10.3.2 The Requirements and Definition of a Global CFfFR

The first step in the design was to determine the requirements for the CFfFR to be globally acceptable. The requirements were determined by performing a systematic review (Table 3.3) during DSR Cycle 1. The results of the systematic review are reported in Chapter 4. A schematic summary of the requirements and the relationship of the requirements with the rest of the financial reporting domain are provided in Figure 4.6.

Based on the requirements for a global CFfFR, a definition that includes the needs, purpose and requirements of a global CFfFR is proposed. The proposed definition is:

A conceptual framework for financial reporting is an internally coherent and logically consistent representation of fundamental concepts that unambiguously prescribes the nature, function and limits of financial reporting.

When the CFfFR ontology was compared to these requirements, the conclusion was made that the research questions were answered (section 8.4.2). It was concluded that the CFfFR ontology serves as a truth-bearing model regarding the formation of a global CFfFR.

The CFfFR ontology as truth container as well as the procedure to build the CFfFR demonstrated how and where the CFfFR could be improved to comply with more requirements and be closer to a global CFfFR. The requirements and proposed definition can serve as a benchmark against which future CFfFRs can be measured to determine their possible global acceptability.

10.3.3 The CFfFR Viewed from a Model Perspective

Once the requirements and definition serving as benchmark against which the CFfFR and CFfFR ontology are tested were determined, the role of a global CFfFR was determined in DSR Cycle 2 and reported in Chapter 5. The status of the CFfFR and role of the CFfFR ontology were tested against the ideal role. The ideal role was determined using the OMG model hierarchy (OMG, 2014; OMG, 2008; Gonzalez-Perez & Henderson-Sellers, 2007). According to the OMG model hierarchy the ideal CFfFR serves as a meta-metamodel in the financial reporting model hierarchy (Figure 5.11 and Figure 5.12). One of the requirements of a meta-metamodel is that a model on a higher hierarchy should be an abstraction of models in a lower hierarchy containing all the concepts of the lower model, but on a more abstract level. Another characteristic of a model hierarchy is that the concepts (classes) and relationships of the models in the hierarchy should be coherent with the concepts (classes) and relationships of other models in the same hierarchy in order for the hierarchy system to be internally coherent.

Based on the characteristics of the OMC hierarchy system it was found that the ideal CFfFR, in order to function as a sound foundation for accounting standards that are internally consistent, should have a meta-metamodel role within a financial reporting model hierarchy (Figure 5.12). Based on the role of the ideal CFfFR it was determined that a global CFfFR should function as a meta-metamodel within the financial reporting domain.

The implication of an ideal and global CFfFR's role as a meta-metamodel is that all the models in the financial reporting hierarchy should be coherent for the hierarchy system to be sound. This means that once a global CFfFR has been developed, it can have a prescriptive role towards the other models in the hierarchy. The role of the ideal and global CFfFR as a meta-metamodel emphasised the importance of the completeness requirement determined during the previous cycle. The ideal CFfFR should contain all the concepts (classes) and relationships of the financial reporting domain, but on a high level of abstraction.

When the current status assigned to the CFfFR was compared to the ideal role of a global CFfFR it was determined that it does not comply with the characteristics of a meta-metamodel. The CFfFR was tested during DSR Cycle 4 and it was found that it does not comply with the completeness requirement, is not internally coherent, logically consistent or completely coherent with the other models (accounting standards) in the financial reporting domain.

The implication of stating the role of a global CFfFR as a meta-metamodel is that the status of the CFfFR should be revised to adopt the role of a meta-metamodel in the financial reporting model hierarchy in order to get closer to the ideal CFfFR to become globally accepted.

10.3.4 Applicability of Ontologies

With the role of an ideal and global CFfFR established as a meta-metamodel in Chapter 5, the applicability of ontologies on the financial reporting domain was

established in Chapter 6 during the execution of DSR Cycle 3. The purpose of DSR Cycle 3 was to explore the possibilities offered by the development and successful use of ontology technologies in other disciplines. The applicability of ontologies on the financial reporting domain was determined from the philosophical and computing disciplines.

The importance of logical consistency as requirement for a global CFfFR was highlighted from a philosophical perspective. It was found that logical consistency is a pre-requisite for the cross-cultural acceptance of theories (section 6.2.3). The implication is that the CFfFR should be logically consistent to be globally accepted across different cultures.

The historical development of ontology as a discipline within philosophy was described to indicate the links between ontology in philosophy, ontologies in computing and the link to the financial reporting domain. The link between ontology in philosophy and the financial reporting domain was established by applying the definition of ontology in philosophy to the financial reporting domain (6.2.1a) and 6.2.1b)). The similarities and differences between ontology in philosophy and ontologies in computing was used to indicate the influence of philosophy on computing and how these two disciplines could benefit the financial reporting domain. The use of logic and more specifically formal logic in philosophy and the application of logic in computing by means of formal languages or artificial languages such as Description Logics (DL) (Figure 6.5) were found to be beneficial for the purpose of this study.

During DSR Cycle 3, the suggestion was made to develop a formal representation of the classes and relationships of CFfFR into a CFfFR ontology using the Web Ontology Language also known as (OWL). OWL is a formal language based on DL. Using OWL made it possible to formalise the classes and relationships of the financial reporting domain as documented in the CFfFR, ensuring that they are logically consistent (Chapter 7).

For the purpose of this study, two important characteristics of ontologies in computing were established during the background study of ontologies in computing. The first characteristic is that ontologies in computing provide a logically consistent and unambiguous presentation of primitive classes of a specified domain (section 6.3.1a)). This characteristic agrees with two requirements of an ideal and global CFfFR, logical consistency and clear formulation. The second characteristic, computational formal logic, takes advantage of the benefit of formal logic by making it computer readable (section 6.3.1b)). The implication of this knowledge for this study was that it made it possible to digitise the classes and relationships of the financial reporting domain in a logically consistent manner.

The applicability of ontology technologies on the financial reporting domain was established by indicating the similarities between conceptual modeling in computing with the CFfFR (section 6.3.2a)). Based on conceptual modeling it was determined that the CFfFR can serve as a digital domain for financial reporting. By combining the knowledge of the power of computational logic (section 6.3.1b)) with the knowledge

of the ideal CFfFR having the role of a meta-metamodel (section 5.3.5), with conceptual modeling and ontologies in the computing discipline (6.3.2c)) a CFfFR ontology hierarchy for the financial reporting domain was developed (Figure 6.6). The CFfFR ontology hierarchy is also based on the OMG model hierarchy.

In section 6.4 it was stated how the use of ontologies in computing assist with answering the research questions. This knowledge was used to suggest the building of a CFfFR ontology that was executed in DSR Cycle 4.

10.3.5 Evaluating the CFfFR by Building a CFfFR Ontology

The OLC Model was used to plan and structure the building of the CFfFR ontology (section 3.8.3). The basic assumptions adopted to build the CFfFR ontology are documented in section 7.2.2. The building of the CFfFR ontology passed through four iterations (sections 7.3, 7.3.5, 7.4.5 and 7.5.3). Sub-research question 3 (SRQ 3) and the main research question were answered during DSR Cycle 4.

By building the CFfFR ontology of the financial reporting domain during DSR Cycle 4, two objectives of the research project were achieved. Firstly, as the natural text of the CFfFR was used as the basis to build the CFfFR ontology, the CFfFR was tested against the requirements of an ideal CFfFR for logical consistency, unintended meanings (ambiguity) and completeness. It was found that the CFfFR is not logically consistent (sections 7.3, 7.3.5) and contains many unintended meanings (sections 7.3, 7.3.5, 7.4.5, 7.5.3). Some ambiguities can be attributed to implied domain knowledge. Although it was not the intention at the start of Iteration 1 to evaluate the CFfFR for completeness, incomplete or missing classes and relationships regarding financial reports were identified during Iterations 3 and 4 (Figure 7.19, Figure 7.21).

In order to formalise the CFfFR, two conceptual understandings of the modeling decisions taken and information to be reported were developed. The first conceptual understanding was the conceptual modeling of the implicit and assumed domain knowledge involved when deciding what, when and how economic activities should be disclosed in a financial report. A decision process filter was developed and informally tested by domain experts for accuracy (Figure 7.19).

The second conceptual understanding is an analysis to distinguish between information that should be formalised (included as of classes and relationships in the CFfFR ontology), and information, although included in the CFfFR, that informs the CFfFR ontology and is not formalised. The detailed analysis to distinguish between formalised information and informative information in the CFfFR is provided in Appendix D – CFfFR working document and decisions. The informative information was labelled as and translated into competency questions in this study. The informative information included in the CFfFR is reported in section 7.6.2 and graphically displayed in Figure 7.21.

By making modeling decisions due to unintended meanings and implicit domain knowledge as well as including information from DP/2013/1 (IASB, 2013a) and a specimen financial report it was possible to formalise most of the classes and

relationships identified in the CFfFR. It was for example not possible to formalise the definitions for income and expense as currently formulated in the CFfFR.

It was found that the use of an ideal model isolated by idealisation and based on false but idealised assumptions could be used to gain knowledge of a social reality such as the CFfFR.

The creation of a CFfFR ontology artefact (although not perfect) implies that it should be possible to adjust the CFfFR to be closer to the ideal CFfFR. By eliminating logical inconsistencies, incompleteness, unintended meanings and implied domain information the CFfFR could be closer to the ideal CFfFR and be more inclined to become globally accepted.

Figure 10.2 is a graphical portrayal of the CFfFR ontology.

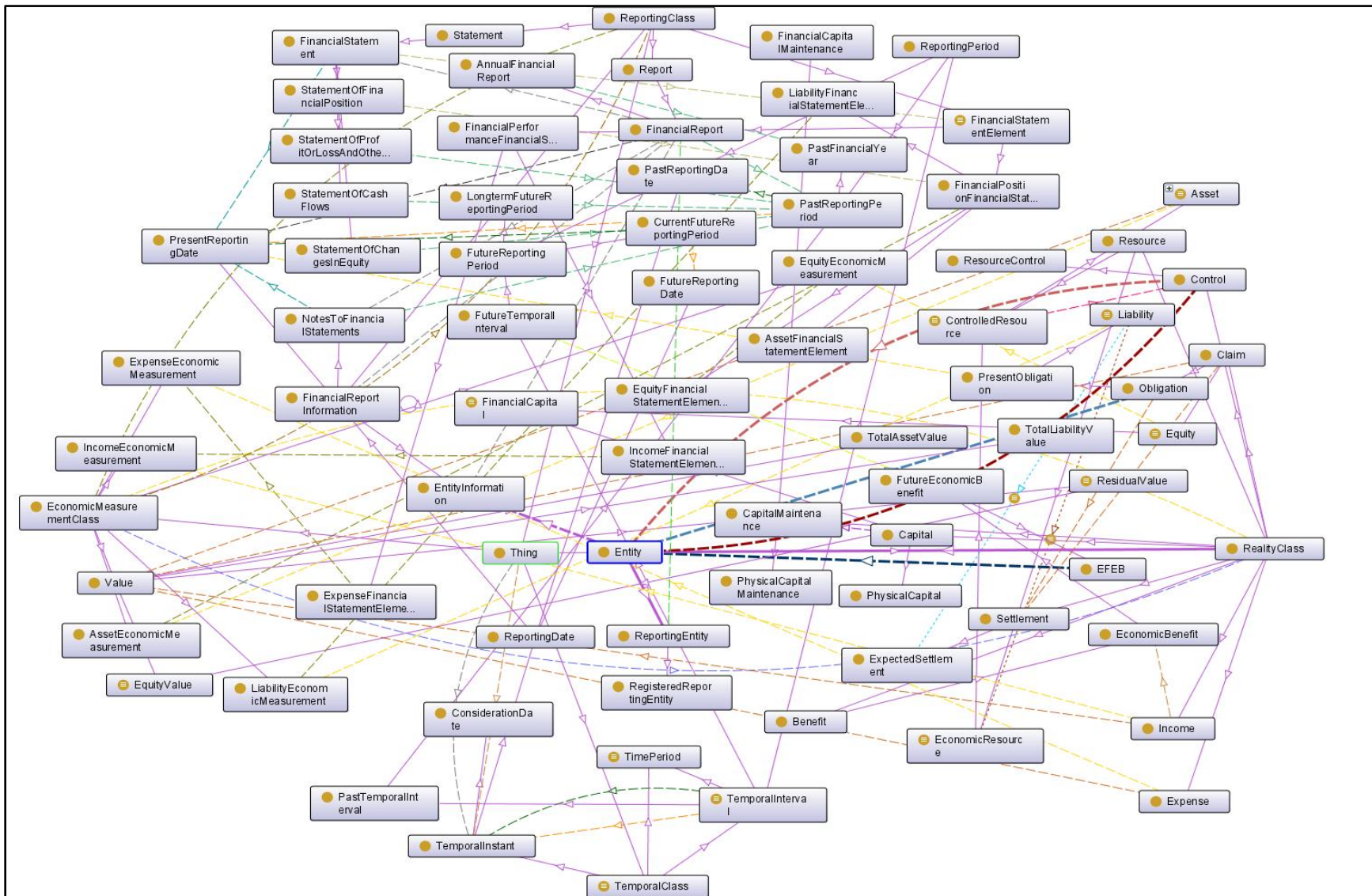


Figure 10.2: CFFR ontology

10.3.6 Answering the Main Research Question

The main research question: How can a CFfFR consisting of logically formalised fundamental concepts can be developed, which could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged? In order for the CFfFR to function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged, the CFfFR itself should be principle-based, internally consistent and internationally converged.

By building the CFfFR in two versions through four Iterations it was indicated where the natural texts of the CFfFR does not comply with the content requirements of a global CFfFR, thus making the CFfFR ontology a truth-bearing model.

The main research question was answered as the formal domain ontology of the CFfFR is principle-based, internally consistent and indicates a method towards a global CFfFR. The CFfFR ontology is principle-based as the classes and relationships and accompanying competency questions represent the most basic principles needed to provide decision-useful information to the users of financial reports. The CFfFR ontology is internally consistent as it was tested for internal and logical consistency with the reasoner. Finally, the CFfFR ontology provides a method and information towards a global CFfFR that can be internationally converged. The contributions of the study to the body of knowledge are summarised in Table 9.2.

10.4 Reflection

This section is a reflection on the extent the research approach influenced the results (methodological reflection). It contains a comparison of the results of this particular research with other research on the same topic (substantive reflection) and the research contribution to the scientific body of knowledge made by this study (scientific contribution).

10.4.1 Methodological Reflection

The qualitative study was conducted from an interpretative ontological perspective (section 3.3.4). The nature of the CFfFR as a social construct constantly changing by way of human intervention motivated the decision to adopt an interpretivist ontological perspective. The modeling decisions made by the researcher were based on interpretations of the information available. The interpretative nature of the modeling decisions can be viewed as subjective involvement of the researcher in making a decision based on the information available at the time the decision had to be made. The interpretative nature of the study also implies that it is possible for another researcher to make modeling decisions that might differ from this study if those decisions are made at another time with more or different information available.

Another researcher could argue that the study can also be performed from a critical realism perspective (section 3.3.3). It is debatable if a critical realism perspective would have resulted in different material findings and contributions. The nature of the CFfFR cannot be classified other than as a social construct with the characteristic of constant change. Modeling decisions would, from a critical realism perspective, still be interpretative in nature. Although this study adopted an interpretative ontological perspective the model theory from Mäki (2008) and some of the ontological theories in computing (Smith & Ceusters, 2010) used in this study have their origins in critical realism. Adopting these theories does not mean that the researcher moved between different ontological perspectives, as the nature of the reality under study and the perspective of the researcher on the reality as well as the subjective nature of the modeling decisions taken did not change. The final motivation to conduct this study from an interpretative perspective is because an explanation in the social sciences invariably entails interpretation, implying some degree of subjective involvement in the decision making process. Ultimately, the researcher formed part of the thought process of other researchers to formulate and create a new social reality - the CFfFR ontology.

Although the DSR approach followed in this study allowed an exploratory approach in an uncertain environment, it added rigour to the process by forcing a consciousness of the reason, purpose, outcome and contribution of every cycle performed. The DSR approach supported the abductive approach to reasoning followed in this study. With the DSR approach, it was possible to stay true to alternating between inductive and deductive reasoning approaches as explained in section 3.4.3. Within the DSR approach, it was possible to use multiple research techniques as indicated in section 3.8 and link these techniques with the required reasoning approach for that specific DSR Cycle in order to obtain the information required.

It can be concluded that the DSR strategy followed in this study added rigour and the flexibility to explore across disciplines in order to be able to address the research problem in a manner that can be scientifically motivated.

10.4.2 Substantive Reflection

The results of this study confirm some of the findings in other studies that a global CFfFR is needed and that the current CFfFR is not internally coherent.

This study differs from the other studies in that it provides a theoretical framework (requirements, definition and role of the CFfFR) as benchmark according to which the CFfFR can be tested. The study further provides a method and procedure, based on ontology technologies accepted in other disciplines that can be used to test a natural text such as the CFfFR or accounting standards against pre-determined requirements.

One of the leading experts on the XBRL-project, Charles Hoffman¹²⁰ (regarded by some as the father of the XBRL-project (Bonsón et al., 2008)), informally confirmed by email the practical value of the contribution made by this study. The following is an extract from an email received from Hoffman regarding Gerber et al. (2015):

“This paper is one of the most fantastic things that I have seen in my entire career in accounting. This is spot on. It really makes no difference if the IASB and/or FASB actually ever do what you are suggesting in your paper (however, that is the obvious best-case scenario...but you know how things go some times). The accounting profession needs an ontology for U.S. GAAP and an ontology for IFRS regardless of what the IASB/FASB do. That would allow accounting professionals to not only discuss the accounting standards more rationally and see that inconsistencies and unintended meanings stand out; but also to build some incredibly interesting tools which would be extremely valuable in financial reporting.”

Although the comment above reflects the opinion of one individual, it provides an indication that the results of this study may have some practical value for the accounting profession.

10.4.3 Scientific Reflection

Section 10.4.2 compared the results of this study with other studies and concluded with an indication of the possible practical value of the study for the accounting profession. This section is a reflection on the contribution to the scientific body of knowledge.

The scientific contribution is provided in Chapter 9. This study contributes towards the body of knowledge by proving that it is possible to create a CFfFR ontology, an artefact, that is logically consistent and internally coherent (Chapters 6 and 7). The creation of a CFfFR ontology based on idealised assumptions made it possible to analyse and identify logical inconsistencies, internal incoherencies, unintended meanings, implied knowledge and incompleteness in the CFfFR in a manner that can be substantiated by methods accepted and used in other disciplines. The information obtained by testing the CFfFR against the requirements and role of an ideal CFfFR makes it possible to adjust the CFfFR to be closer to a global CFfFR.

The requirements identified in Chapter 4 contribute a summary of information previously known, but not explicitly formulated as requirements for the CFfFR. The requirements provide a standard against which the CFfFR can be measured. Based on the identified requirements it was possible to formulate a definition for a global CFfFR.

In Chapter 5, the role of the ideal CFfFR was determined as that of a meta-metamodel within the financial reporting domain. Although this role differs from the current status of

¹²⁰ The work done by Hoffman can be viewed at his website (Hoffman, 2015).

the CFfFR, it is an indication of the role that a global CFfFR should have. The knowledge that it is possible to build a CFfFR ontology with a natural text document as source makes it possible to consider building ontologies of accounting standards with their respective natural texts as sources.

In conclusion, it can be said that it is now known how the accounting profession can build a CFfFR that could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged.

10.5 Limitations of the Research

The following limitations were identified when conducting the research:

- The study did not adjust or suggest detail adjustments to the CFfFR. This study can only make some suggestions that could be considered by standard setting bodies.
- The value of the study ultimately depends on the manner in which the contributions are accepted and implemented in the accounting community. This study does not have any control or influence over the acceptance and implementation of the contributions. The value of the study was confirmed in a limited manner by the publication of some of the results through a peer-reviewed system. These publications are considered as part of the validation of the value of the results.
- The “consulting process” on implied domain knowledge and unintended meanings were limited to the natural text of the CFfFR, DP/2013/1 and a specimen of a financial report. This limitation was decided on to be able to test the clarity with which the natural text of the CFfFR communicates most concepts of the financial reporting domain. Ultimately, the accounting community should become more involved in this study to prove the value of the study.
- DSR strategy is not familiar in the accounting community as a research strategy. Although it was presented as a contribution, the DSR strategy followed can also be seen as a threat to the study as it has not been used before in an accounting study. The unfamiliarity could cause some scepticism in the accounting community with regards to accepting the results obtained by using this strategy. After considering the benefits offered by the DSR strategy within this multi-disciplinary study, it was decided that the benefits offered by a DSR strategy outweighs the possible scepticism.
- Although the CFfFR ontology is the result of a fourth iteration it should be refined more once more accounting domain experts and ontology experts get involved.
- The ontology technologies used are not readily accessible to accounting experts and the input of an ontology engineer is essential. This limitation is not unique to this

study. The building of a domain ontology always involve the input of both ontology engineers and domain experts.

10.6 Areas for Further Research

Some of the areas for further research relate to the limitations indicated in section 10.5.

- The CFfFR ontology should be refined with inputs from more accounting domain experts to provide an ontology that represents the agreed upon knowledge of the accounting discipline.
- Input from domain experts should be obtained to help with the identification of implicit domain knowledge in the CFfFR and accounting standards and making that knowledge explicit in an ontology.
- The building of ontologies of accounting standards should be considered. By integrating the ontologies of the CFfFR and accounting standards into one ontology, it could be possible to create an ontology of the financial reporting domain as indicated in the OMG four level ontology hierarchy of the financial reporting domain (Figure 6.6). The integration of the CFfFR ontology and accounting standard ontologies could provide valuable information regarding the logical consistency between accounting standards and the CFfFR. These ontologies could also assist in identifying incoherence between the different standards as well as between the standards and the CFfFR. This integration would contribute towards the ideal role of the CFfFR as a meta-metamodel.
- The integration of a financial reporting domain ontology with the XBRL-project should be investigated. An integration between these two areas could contribute to digitalizing the complete financial reporting domain, from the initial economic activity to the publication of a financial report.

10.7 Conclusion

This study has developed an artefact, a CFfFR ontology, by performing design science on the financial reporting domain. In order to develop the CFfFR ontology the requirements and role of a global CFfFR were determined. By developing the CFfFR ontology, the CFfFR was tested for global acceptability against the requirements and role. The study indicates some logical inconsistencies, unintended meanings, implicit domain knowledge and incomplete areas in the CFfFR that need to be addressed in order for it to be more globally acceptable. By highlighting these problem areas in the CFfFR it was indicated how the accounting profession could build a CFfFR that could function as a sound foundation for accounting standards that are principle-based, internally consistent and internationally converged as indicated in section 10.3.6.

11 REFERENCES

- AAA. 2015. American Accounting Association - About. <http://aaahq.org/About>. Date accessed: 21/04/2015.
- Abdullah, M. G., M. C. Anderson, M. J. Anderson, A. Augustyn, M. L. Barton, and E. Al. 2015. Teleology. *Encyclopaedia Britannica Online*. Encyclopaedia Britannica Inc.
- Ager, S. 2013. Sumerian cuneiform script and Sumerian language. *Omniglot: The online encyclopaedia of writing systems & languages*. <http://www.omniglot.com/writing/sumerian.htm>. Date accessed: 04/06/2013.
- Agrawal, S. P., P. H. Jensen, A. L. Meador, and K. Sellers. 1989. An International Comparison of Conceptual Frameworks of Accounting. *International Journal of Accounting* 24 (3): 237.
- AICPA. 2015. History of the AICPA. http://www.aicpa.org/about/missionandhistory/pages/history_of_the_aicpa.aspx. Date accessed: 21/04/2015.
- Alexander, D., A. Le Manh-Béna, and O. Ramond. 2013. Can the conceptual framework be all things to all (wo)men? In *Comptabilité sans Frontières... The French Connection*, 1–23.
- American Accounting Association. 1936. *A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements*. American Accounting Association.
- Antonites, A. 2006. Relativisme as epistemologiese probleem. *Tydskrif vir Geesteswetenskappe* 46 (1): 27–51.
- Aparaschivei, F. 2007. The importance of an accounting ontology. *Economy Informatics* 1 (4): 5–10.
- Arnold, A. J., and S. McCartney. 2002. The beginnings of accounting for capital consumption: disclosure practices in the British railway industry, 1830–55. *Accounting and Business Research* 32 (4): 195–208.
- . 2008. The transition to financial capitalism and its implications for financial reporting: Evidence from the English canal companies. *Accounting, Auditing & Accountability Journal* 21 (8): 1185–1209.
- Artale, A., N. Guarino, and C. M. Keet. 2008. Formalising Temporal Constraints on Part-Whole Relations. In *Journal of Web Semantics*, 5:46.
- Austin, M. M., and P. Vidal-Naquet. 1980. *Economic and Social History of Ancient Greece: An Introduction*. University of California Press.
- Baader, F, D Calvanese, DL McGuinness, D Nardi, and PF Patel-Schneider, eds. 2007. *The Description Logic Handbook: Theory, Implementation, and Applications*. Second. Cambridge: Cambridge University Press.

- Barth, M. E. 2006. Research, Standard Setting, and Global Financial Reporting. *Foundations and Trends in Accounting* 1 (2): 71–165.
- . 2008. Global Financial Reporting: Implications for U.S. Academics. *The Accounting Review* 83 (5): 1159–1179.
- . 2013a. Measurement in financial reporting: the need for concepts. *Accounting Horizons*.
- . 2013b. Global Comparability in Financial Reporting: What, Why, How, and When? *China Journal of Accounting Studies* 1 (1): 2–12.
- Basili, R., and M. T. Pazienza. 1993. Inducing a CG representation for basic-level categorization of verbs. In *Conceptual Graphs for Knowledge Representation: First International Conference on Conceptual Structures, ICCS'93*, edited by G. W. Mineau, B. Moulin, and J. F. Sowa, 162–181. Quebec City, Canada.: Berlin : Springer.
- Berners-Lee, T. 1996. WWW: Past, Present, and Future. *IEEE Computer* 29 (10): 69–77.
- Berners-Lee, T., J. Hendler, and O. Lassila. 2001. The semantic Web. *Scientific American* 284 (5): 34–43.
- Bhimani, A. 2008. The role of a crisis in reshaping the role of accounting. *Journal of Accounting and Public Policy* 27 (6): 444–454.
- Biggs, R. D. 2009. An Archaic Sumerian Version of the Kesh Temple Hymn from Tell Abū Šalābīkh. *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 61 (2): 193–207.
- Biolchini, J. de A., P. G. Mian, A. C. C. Natali, T. U. Conte, and G. H. Travassos. 2007. Scientific research ontology to support systematic review in software engineering. *Advanced Engineering Informatics* 21 (1): 133–151.
- Biolchini, J. de A., P. G. Mian, A. C. C. Natali, and G. H. Travassos. 2005. Systematic Review in Software Engineering. *Technical Report ES679/05*. Rio de Janeiro: Systems Engineering and Computer Science Department. COPPE / UFRJ.
- Bohr, N. 1961. *Atomic Physics and Human Knowledge*. New York : Wiley: Science Editions.
- Bonsón, E., T. Escobar, and F. Flores. 2008. XBRL: Overcoming Scepticism of Global Regulators. *Online* 32 (2): 23–25.
- Booth, B. 2003. The conceptual framework as a coherent system for the development of accounting standards. *Abacus* 39 (3): 310–324.
- Borgida, A., and R. J. Brachman. 2003. Conceptual Modeling with Description Logics. In *Description logic handbook: theory, implementation, and applications.*, edited by F. Baader, D. Calvanese, D. L. McGuinness, D. Nardi, and P. F. Patel-Schneider, 359–381. Cambridge: Cambridge University Press.

- Borgo, S., and C. Masolo. 2009. Foundational choices in DOLCE. In *Handbook on Ontologies (Second Edition)*, edited by S. Staab and R. Studer, 361–382. Springer Berlin Heidelberg.
- Brewster, C., and K. O'Hara. 2007. Knowledge representation with ontologies: Present challenges—Future possibilities. *International Journal of Human-Computer Studies* 65 (7): 563–568.
- Briloff, A. J. 1966. Old Myths and New Realities in Accountancy. *The Accounting Review* 41 (3): 484–495.
- Broekstra, J., M. Klein, S. Decker, D. Fensel, F. van Harmelen, and I. Horrocks. 2001. Enabling Knowledge Representation on the Web by Extending RDF Schema. In *Accounting, Organizations and Society*, ACM 1-5811:467. Addison Wesley Professional.
- Brown, R. 1905. *A History of Accounting and Accountants*. Washington, D.C.: Beard Books.
- Brunner, K., and A. H. Meltzer. 1971. The Uses of Money: Money in the Theory of an Exchange Economy. *The American Economic Review*.
http://www.jstor.org/stable/1813142?seq=1#page_scan_tab_contents.
- Bryer, R. A. 1991. Accounting for the “railway mania” of 1845— A great railway swindle? *Accounting, Organizations and Society* 16 (5): 439–486.
- Bullen, H. G., and K. Crook. 2005. *Revisiting the Concepts: A New Conceptual Framework Project*. New York and London: FASB and IASB.
- Burlaud, A., and B. Colasse. 2011. International Accounting Standardisation: Is Politics Back? *Accounting in Europe* 8 (1): 23–47.
- Calvanese, D., and G. De Giacomo. 2003. Expressive Description Logics. In *The Description Logics Handbook: theory, implementation, and applications*, edited by F. Baader, D. Calvanese, D. L. Mcguinness, D. Nardi, and P. Patel-Schneider, 184–225. Cambridge: Cambridge University Press.
- Cambridge Dictionaries Online. 2015. Concept.
<http://dictionary.cambridge.org/dictionary/british/concept>. Date accessed: 05/08/2015.
- Camfferman, K., and S. A. Zeff. 2009. *Financial Reporting and Global Capital Markets: A History of the International Accounting Standards Committee 1973-2000*. Upper Saddle River, N.J: Oxford University Press.
- Campbell, G. 2010. *Cross-Section of a 'Bubble': Stock Prices and Dividends during the British Railway Mania*. Belfast: Queen's University Belfast.
- Carlson, M. L., and J. W. Lamb. 1981. Constructing a Theory of Accounting - An Axiomatic Approach. *The Accounting Review* 56 (3): 554–573.
- Chambers, R. J. 1963. Why bother with postulates? *Journal of Accounting Research* 1 (1): 3–15.

- Chambers, R. J. 1996. Ends, ways, means and conceptual frameworks. *Abacus* 32 (2): 119–132.
- Chou, C.-C., and Y.-L. Chi. 2010. Developing ontology-based EPA for representing accounting principles in a reusable knowledge component. *Expert Systems with Applications* 37 (3): 2316–2323.
- Chou, T.-H., J. A. Vassar, and B. Lin. 2008. Knowledge management via ontology development in accounting. *Kybernetes* 37 (1): 36–48.
- Clark, K. 2008. Conceptual Framework Project: What is a conceptual framework and why is it necessary? *Charter* 79 (10): 60–61.
- Collins English Dictionary. 2015. Definition of “concept.”
<http://www.collinsdictionary.com/dictionary/english/concept>. Date accessed: 18/05/2015.
- Corazzon, R. 2010. The Problem of Universals : The Contemporary Debate. *Theory and History of Ontology*. <http://www.ontology.co/idx00.htm>. Date accessed: 21/04/2014.
- . 2013. Theory and History of Ontology. <http://www.ontology.co/idx00.htm>. Date accessed: 21/04/2014.
- Corns, D. 1996. Evolution before revolution. *Management Accounting* 74 (4): 16–18.
- Craig, E. 1998. Ontology. In *Routledge Encyclopaedia of philosophy online*, edited by E. Craig. 2.0 ed. London: Routledge.
- Dahab, M. Y., H. A. Hassan, and A. Rafea. 2008. TextOntoEx: Automatic ontology construction from natural English text. *Expert Systems with Applications* 34 (2): 1474–1480.
- Dancy, R. M. 2001. Aristotle. In *A Companion to The Philosophers*, edited by R. L. Arrington, 132–147. Malden, Massachusetts: Blackwell Publishing Ltd.
- Deegan, C. 2014. *Financial Accounting Theory*. 4th ed. Sydney, NSW: McGraw-Hill Education (Australia) Pty Ltd.
- Deloitte. 2015. Global financial crisis. *IAS Plus*. <http://www.iasplus.com/en/resources/topics/gfc>. Date accessed: 19/07/2015.
- DePree, C. M. 1989. Testing and Evaluating a Conceptual Framework of Accounting. *Abacus* 25 (2): 61 – 73.
- Dunning, J., and R. Pearce. 1995. The nature and growth of MNEs. In *Comparative International Accounting*, edited by C. Nobes and R. Parker, 22–43. Fourth. New York: Prentice Hall.
- Edgar, M. 2013. Bernard Bolzano. Ed. E. N. Zalta. *The Stanford Encyclopaedia of Philosophy*. Stanford.

- Edwards, J. D. 1960. Early Bookkeeping and its Development into Accounting. *Business History Review* 34 (04): 446–458.
- Edwards, J. R. 1989. *A History of Financial Accounting*. New York: Routledge.
- . 1996. Financial Accounting Practice 1600-1970: Continuity and Change. In *Accounting History from the Renaissance to the Present: A Remembrance of Luca Pacioli*, edited by T. A. Lee, A. Bishop, and R. H. Parker, 31 – 70. New York: Garland Publishing, Inc.
- Edwards, JR, and SP Walker, eds. 2009. *The Routledge Companion to Accounting History*. New York: Routledge.
- Evans, T. G. 2003. *Accounting Theory: Contemporary Accounting Issues*. Ohio: Thomson Learning.
- FASAC. 2004. Revisiting the FASB’s Conceptual Framework. Norwalk, Connecticut: Financial Accounting Standards Advisory Council.
- FASB. 2010a. Statement of Financial Accounting Concepts No. 8: Conceptual Framework for Financial Reporting. Norwalk, Connecticut: FASB.
- . 2010b. *Conceptual Framework for Financial Reporting and Accounting, Discussion Memorandum*. Norwalk, Connecticut: FASB.
- . 2014a. International Convergence of Accounting Standards—A Brief History. <http://www.fasb.org/jsp/FASB/Page/SectionPage&cid=1176156304264>. Date accessed: 05/01/2014.
- . 2014b. Conceptual Framework - Joint project of the IASB and FASB. http://www.fasb.org/cs/ContentServer?c=FASBContent_C&pagename=FASB/FASBContent_C/ProjectUpdatePage&cid=900000011090. Date accessed: 13/02/2014.
- FASB and IASB. 2002. The Norwalk Agreement. New York : Wiley: FASB and IASB.
- . 2010. Minutes of November 17, 2010, Joint Board Meeting; Conceptual Framework. New York and London: FASB and IASB.
- Flahive, A., D. Taniar, W. Rahayu, and B. O. Apduhan. 2009. Ontology tailoring in the Semantic Grid. *Computer Standards & Interfaces* 31 (5): 870–885.
- Fleischman, R. K., and T. N. Tyson. 1993. Cost accounting during the industrial revolution. the present state of historical knowledge. *The Economic History Review* 46 (3): 503–517.
- Fogo, J. R. 1905. History of Book-keeping. In *A History of Accounting and Accountants*, edited by R. Brown, 93–170. Washington, D.C.: Beard Books.
- Förster, E. 2011. Kant. In *The Routledge Companion to Epistemology*, edited by S. Bernecker and D. Pritchard, 741–749. New York and London: Routledge.

- Gaffikin, M. J. R. 1987. The Methodology of Early Accounting Theorists. *Abacus* 23 (1): 17–30.
- . 2008. *Accounting theory: research, regulation and accounting practice. Faculty of Commerce - Papers (Archive)*. Frechs Forest, N.S.W.: Pearson Education Australia.
- Gangemi, A., N. Guarino, C. Masolo, A. Oltramari, and L. Schneider. 2002. Sweetening Ontologies with DOLCE. In *Knowledge engineering and knowledge management: Ontologies and the semantic Web.*, 166–181. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg.
- Garnsey, M. R., A. I. Nicolaou, and E. B. Ponte. 2008. Seventeenth Annual Research Workshop on Artificial Intelligence and Emerging Technologies in Accounting , Auditing and Tax (August): 2008.
- Gene Ontology Consortium. 2015. Gene Ontology Home. <http://geneontology.org/#carousellanding>. Date accessed: 10/11/2015.
- Gerber, M. C., and A. J. Gerber. 2011. Towards the development of consistent and unambiguous financial accounting standards using ontology technologies. In *Proceedings of the International Conference on Accounting 2011*. Venice: IAAER.
- Gerber, M. C., A. J. Gerber, and A. J. Van der Merwe. 2014. An Analysis of Fundamental Concepts in the Conceptual Framework Using Ontology Technologies. *South African Journal of Economic & Management Sciences* 17 (4): 396–411.
- Gerber, M. C., A. J. Gerber, and A. J. Van der Merwe. 2015. The Conceptual Framework for Financial Reporting as a Domain Ontology. In *Americas Conference on Information Systems - AMCIS 2015 (accepted for publication)*. Puerto Rico: AMCIS.
- Gerber, M. C., A. J. Gerber, A. J. Van der Merwe, and N. Stegmann. 2015. Formalising the Definitions of the Elements of the Statement of Financial Position. In *SAAA & IAAER Conference - 2015 (Accepted for publication)*. East London, South Africa: SAAA.
- Gonzalez-Perez, C., and B. Henderson-Sellers. 2007. Modeling software development methodologies: A conceptual foundation. *Journal of Systems and Software* 80 (11): 1778–1796.
- Gore, R., and D. Zimmerman. 2007. Building the Foundations of Financial Reporting: The Conceptual Framework. *The CPA Journal* 77 (8): 30–34.
- Green, M. W. 1989. Early Cuneiform. In *The Origins of Writing*, edited by Senner Wayne M., 43–57. Lincoln and London: University of Nebraska Press.
- Green, S., J. P. T. Higgins, P. Alderson, M. Clarcke, C. D. Mulrow, and A. D. Oxman. 2008. Introduction. In *Cochrane Handbook for Systematic Reviews of Interventions*, edited by J. P. Higgins and S. Green, 3–10. Chichester, UK: John Wiley & Sons, Ltd.
- Green, W. L. 1986. *History and Survey of Accountancy*. Osaka: Garland Publishers.

- Grenon, P., and B. Smith. 2009. Foundations of an ontology of philosophy. *Synthese* 182 (2): 185–204.
- Gruber, T. R. 1992. Ontolingua: A Mechanism to Support Portable Ontologies. *Knowledge Systems Laboratory, Stanford University*. Stanford, CA, USA: Knowledge Systems Laboratory, Stanford University. <http://www-hsl.stanford.edu/knowledge-sharing/ontolingua>. Date accessed: 29/02/2014.
- . 1993. A translation approach to portable ontology specifications. *Knowledge Acquisition* 5 (2): 199–220.
- . 1995. Towards principles for the design of ontologies used for knowledge sharing. *International Journal for Human-Computer Studies* 43: 907–928.
- . 2002. What is an Ontology? *Knowledge Systems, AI Laboratory, Stanford University*. <http://www.ksl.stanford.edu/kst/what-is-an-ontology.html>. Date accessed: 21/02/2014.
- Grüne-Yanoff, T., and U. Mäki. 2014. Introduction: Interdisciplinary model exchanges. *Studies in History and Philosophy of Science Part A* In press.
- Guan, J., A. S. Levitan, and J. R. Kuhn. 2013. How AIS can progress along with ontology research in IS. *International Journal of Accounting Information Systems* 14 (1): 21–38.
- Guarino, N. 1997. Understanding, building and using ontologies. *International Journal of Human-Computer Studies* 46 (2-3): 293–310.
- . 1998. Formal ontology in information systems. In *Proceedings of the first international conference (FOIS'98)*, 3–15. Trento, Italy: IOS Press.
- . 2015. DOLCE. *Laboratory for Applied Ontology*. <http://www.loa.istc.cnr.it/old/DOLCE.html>. Date accessed: 15/04/2015.
- Guarino, N., D. Oberle, and S. Staab. 2009. What Is An Ontology? In *Handbook on Ontologies*, edited by S. Staab and R. Struder. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg.
- Guizzardi, G. 2005. Ontological Foundations for Structural Conceptual Models. Enschede, The Netherlands: University of Twente.
- . 2006. The Role of Foundational Ontologies for Conceptual Modeling and Domain Ontology Representation. In *2006 7th International Baltic Conference on Databases and Information Systems*, 5:17–25. 1.
- . 2007. On Ontology, ontologies, Conceptualizations, Modeling Languages, and (Meta)Models. In *Frontiers in artificial intelligence and applications: Databases and Information Systems IV*, edited by O. Vasilecas, J. Eder, and A. Caplinskas, 155:18–39. Amsterdam: IOS Press.
- Guizzardi, G., and T. Halpin. 2008. Ontological foundations for conceptual modeling. *Applied Ontology* 3 (Number 1-2/2008): 1–12.

- Guizzardi, G., H. Herre, and G. Wagner. 2003. On the general ontological foundations of conceptual modeling. *Conceptual Modeling—ER 2002*.
- Gutiérrez, F., C. Larringage, and M. Núñez. 2005. Cost and Management Accounting in Pre-Industrial Revolution Spain. *The Accounting Historians Journal* 32 (1): 111–148.
- Hail, L., C. Leuz, and P. Wysocki. 2010. Global accounting convergence and the potential adoption of IFRS by the US (Part II): Political factors and future scenarios for US accounting standards. *Accounting Horizons* 24 (4): 567–588.
- Hain, H. P. 1966. Accounting Control in the Zenon Papyri. *The Accounting Review* 41 (4): 699–703.
- Harden, A., and J. Thomas. 2010. Mixed Methods and Systematic Reviews: Examples and Emerging Issues. In *SAGE Handbook of Mixed Methods in Social & Behavioural Research*, edited by A. Tashakkori and C. Teddlie, 893. 2nd ed. London: SAGE Publications, Inc.
- Hatfield, H. 1909. *Modern Accounting*. D Appleton and Company. New York: D Appleton and Company.
- Heidegger, M. 1999. *Ontology: The Hermeneutics of Facticity*. Indiana, U.S.A.: Indiana University Press.
- Henderson-Sellers, B. 2007. On the Challenges of Correctly Using Metamodels in Software Engineering. In *New Trends in Software Methodologies, Tools and Techniques*, edited by H. Fujita and D. Pisanelli, 3–35. Amsterdam: IOS Press.
- . 2011a. Random Thoughts on Multi-level Conceptual Modeling. In *The Evolution of Conceptual Modeling: From a Historical Perspective towards the Future of Conceptual Modeling*, edited by R. Kaschek and L. Delcambre, 6520:93–116. Lecture Notes in Computer Science. Berlin, Heidelberg: Springer Berlin Heidelberg.
- . 2011b. Bridging metamodels and ontologies in software engineering. *Journal of Systems and Software* 84 (2): 301–313.
- Hendriksen, E. S. 1970. *Accounting Theory*. Revised Ed. London: Richard D. Irwin, Inc.
- Hendriksen, E. S., and M. F. Van Breda. 1992. *Accounting theory*. 5th ed. Homewood, Ill: Irwin.
- Hettche, M. 2014. Christian Wolff. Ed. E. N. Zalta. *The Stanford Encyclopaedia of Philosophy*. Stanford.
- Hevner, A., and S. Chatterjee. 2010. *Design Research in Information Systems: Theory and Practice*. Integrated Series in Information Systems. Boston, MA, MA: Springer US.
- Hevner, A. R., S. T. March, J. Park, and S. Ram. 2004. Design science in information systems research. *MIS quarterly* 28 (1): 75–105.

- Hines, R. D. 1988. Financial accounting: In communicating reality, we construct reality. *Accounting, Organizations and Society* 13 (3): 251–261.
- . 1989. Financial accounting knowledge, conceptual framework projects and the social construction of the accounting profession. *Accounting, Auditing & Accountability Journal* 2 (2): 72 – 92.
- Hintikka, J. J. 2014. Philosophy of Logic. *Encyclopaedia Britannica Online*.
- Hobbs, J. R., and F. Pan. 2004. An Ontology of Time for the Semantic Web. *ACM Transactions on Asian Language Processing (TALIP): Special issue on Temporal Information Processing* 3 (1): 66–85.
- Hoffman, C. 2015. Digital Financial Reporting. <http://xbrl.squarespace.com/about-the-author/>. Date accessed: 12/06/2015.
- Hoffmann, S., and D. Detzen. 2013. The conceptual Framework's (in-) adequacy for standard setting Manuscript B. In *Conceptual and Historical Underpinnings of Accounting*, edited by D. Detzen, H. Zülch, and T. Wulf, 77–132. Leipzig, Germany: HHL Leipzig Graduate School of Management.
- Hofweber, T. 2009. Formal Tools and the Philosophy of Mathematics. In *New Waves in Philosophy of Mathematics*, edited by O. Bueno and Ø. Linnebo, 209–231. Hampshire and New York: Palgrave Macmillan.
- . 2013. Logic and Ontology. In *The Stanford Encyclopaedia of Philosophy*, edited by E. N. Zalta. Stanford.
- Horridge, M. 2009. Protégé OWL Tutorial. <http://130.88.198.11/tutorials/protegeowltutorial/>. Date accessed: 03/08/2014.
- Hussein, M. E. 1996. A comparative study of cultural influences on financial reporting in the US and the Netherlands. *The International Journal of Accounting* 31 (1): 95–120.
- IASB. 1989. Framework for the Preparation and Presentation of Financial Statements. London: IASC Foundation.
- . 2010a. The Conceptual Framework for Financial Reporting. London: IFRS Foundation.
- . 2010b. Conceptual Framework for Financial Reporting ED/2010/2. London: United Kingdom: IASCF.
- . 2010c. How we develop IFRSs. London: IASB. <http://www.ifrs.org/How-we-develop-standards/Pages/How-we-develop-standards.aspx>. Date accessed: 15/01/2014.
- . 2010d. The Conceptual Framework for Financial Reporting. London: IFRS Foundation.
- . 2012a. IASB Update May 2012. *IASB Update*. <http://media.ifrs.org/IASBupdateMay2012.html#7>. Date accessed: 06/01/2014.

- . 2012b. *Feedback Statement: Agenda Consultation 2011*. London: United Kingdom.
- . 2012c. About advisory bodies. http://www.ifrs.org/The+organisation/Advisory+bodies/About_advisory_bodies.htm. 08/05/2012.
- . 2013a. *A Review of the Conceptual Framework for Financial Reporting. DP/2013/1*. Discussion Paper. London: United Kingdom.
- . 2013b. *A Review of the Conceptual Framework for Financial Reporting. DP/2013/1*. Discussion Paper. London: United Kingdom.
- . 2014a. IASB Web Page: Conceptual Framework. <http://www.ifrs.org/Current-Projects/IASB-Projects/Conceptual-Framework/Pages/Conceptual-Framework-Summary.aspx>. Date accessed: 23/06/2014.
- . 2014b. AP10E - Conceptual Framework. Purpose and status of the Conceptual Framework. London: IASB. <http://www.ifrs.org/Current-Projects/IASB-Projects/Conceptual-Framework/Pages/Conceptual-Framework-Summary.aspx>. Date accessed: 09/01/2014.
- . 2015a. Search Results : Financial Crisis. *Website of the IFRS Foundation and the IASB*. [http://www.ifrs.org/search/Pages/results.aspx?k=financial crisis](http://www.ifrs.org/search/Pages/results.aspx?k=financial+crisis). Date accessed: 19/07/2015.
- . 2015b. Areas within the Financial Crisis Advisory Group scope. *Website of the IFRS Foundation and the IASB*. <http://www.ifrs.org/The-organisation/Pages/Areas-within-the-Financial-Crisis-Advisory-Group-scope.aspx>. Date accessed: 19/07/2015.
- . 2015c. IFRS 9 Financial Instruments (replacement of IAS 39). *Website of the IFRS Foundation and the IASB*. <http://www.ifrs.org/Current-Projects/IASB-Projects/Financial-Instruments-A-Replacement-of-IAS-39-Financial-Instruments-Recognitio/Pages/Financial-Instruments-Replacement-of-IAS-39.aspx>. Date accessed: 19/07/2015.
- . 2015d. *Exposure Draft ED/2015/3: Conceptual Framework for Financial Reporting*. London.
- Ijiri, Y. 1995. The Beauty of Double-Entry Bookkeeping and its Impact on the Nature of Accounting Information. In *Proceedings of The Conference Accounting and Economics: In Honour of the 500th Anniversary of the Publication of Luca Pacioli's Summa de Arithetica, Geometria, Proportioni et Proportionalita, Siena, 18th-19th November 1992*, edited by M. Shubik, 265–285. New York: Garland Publishing, Inc.
- ISO. 2014. International Organization for Standardization. <http://www.iso.org/iso/home.html>. Date accessed: 11/07/2014.
- Jaggi, B., and P. Y. Low. 2000. Impact of Culture, Market Forces, and Legal System on Financial Disclosures. *The International Journal of Accounting* 35 (4): 495–519.

- Kee, R. 1993. Data processing technology and accounting: A historical perspective. *The Accounting Historians Journal* 20 (2): 187–216.
- Keister, O. R. 1970. The Influence of Mesopotamian Record-keeping. *Abacus* 6 (2): 169–181.
- Klein, G. O., and B. Smith. 2010. Concept Systems and Ontologies: Recommendations for Basic Terminology. *Transactions of the Japanese Society for Artificial Intelligence* 25 (3): 433–441.
- Kraayenhof, J. 1960. International Challenges for Accounting. *The Journal of Accountancy* 109 (1): 34–38.
- Krahel, J. 2012. On the Formalization of Accounting Standards. State University of New Jersey.
- Krieger, H. 2008. Where Temporal Description Logics Fail : Representing Temporally-Changing. *KI2008: Advances in Artificial Intelligence. Lecture Notes in Computer Science* 5243: 249–257.
- Kuechler, B., and V. Vaishnavi. 2008. On theory development in design science research: anatomy of a research project. *European Journal of Information Systems* 17: 489–504.
- Kühne, T. 2005. What is a Model? In *Language Engineering for Model-Driven Software Development*, edited by J. Bezivin and R. Heckel, 1–10. Dagstuhl, Germany: Schloss Dagstuhl - Leibniz-Zentrum für Informatik.
- . 2006a. Clarifying matters of (meta-) modeling: an author's reply. *Software and Systems Modeling* 5 (4): 395–401.
- . 2006b. Matters of (Meta-) Modeling. *Software & Systems Modeling* 5 (4): 369–385.
- Lee, T. A. 2015. Accounting and the Decision Usefulness Framework. In *The Routledge Companion to Financial Accounting Theory*, edited by S. Jones, 108–128. 1st ed. New York: Routledge.
- Litherland, K., P. Carmichael, and A. Martínez-García. 2013. Ontology-based e-assessment for accounting: Outcomes of a pilot study and future prospects. *Journal of Accounting Education* 31 (2): 162–176.
- Littleton, A. C. 1966. *Accounting evolution to 1900*. New York: Russell & Russell.
- Llorens, M. B. 2000. The crisis of 1847-1848 and the regulation of company accounting in Spain. *Accounting History* 5 (2): 13.
- Lopez, R. S., and I. W. Raymond. 2001. *Medieval Trade in the Mediterranean World: Illustrative Documents*. New York: Columbia University Press.
- Losee, J. 2001. *A Historical Introduction to the Philosophy of Science, Fourth edition*. 4th ed. New York: Oxford University Press.

- Louw, J. P., E. A. Nida, R. Smith, and K. Munson. 1989. *Greek-English lexicon of the New Testament: Based on semantic domains*. Ed. J. P. Louw and E. A. Nida. New York: United Bible Societies.
- Lutz, C., F. Wolter, and M. Zakharyashev. 2008. Temporal Description Logics: A Survey. *2008 15th International Symposium on Temporal Representation and Reasoning*: 3–14.
- Lyall, C., A. Bruce, J. Tait, and L. Meagher. 2011. *Interdisciplinary Research Journeys: Practical Strategies for Capturing Creativity*. FT Press.
- Ma, J. 2007. Ontological considerations of time, meta-predicates and temporal propositions. *Applied Ontology* 2: 37–66.
- Mackintosh, I. 2014. *Are True Global Standards Achievable?* Johannesburg: IASB.
- Macve, R. H. 1996. Pacioli's Legacy. In *Accounting History from the Renaissance to the Present: A Remembrance of Luca Pacioli*, edited by A. P. R. H. Lee, T.A. Bishop, 3–30. London: United Kingdom: Garland Publishing, Inc.
- . 2010. Conceptual frameworks of accounting: some brief reflections on theory and practice. *International Accounting Policy Forum* 40 (3): 303–308.
- Mäki, U. 2008. Scientific realism and ontology. In *The new Palgrave dictionary of economics*, edited by S. N. Durlauf and L. E. Blume, 334–341. 2nd ed. Palgrave Macmillan.
- . 2009. Missing the World. Models as Isolations and Credible Surrogate Systems. *Erkenntnis* 70 (1): 29–43.
- . 2011. Models and the locus of their truth. *Synthese* 5 (1): 47–63.
- Malinvaud, E. 1995. The Demands of Macroeconomic Theory to Accounting. In *Proceedings of The Conference Accounting and Economics: In Honour of the 500th Anniversary of the Publication of Luca Pacioli's Summa de Arithetica, Geometria, Proportioni et Proportionalita, Siena, 18th-19th November 1992*, edited by M. Shubik, 211–219. New York and London: Garland Publishing, Inc.
- March, S. T., and V. C. Storey. 2008. Design Science in the Information Systems Discipline: An introduction to the special issue on design science research. *MIS Quarterly* 32 (4): 725–730.
- Maria, B. P., and C. Larrinaga-Gonzalez. 2001. Cost accounting in eighteenth century Spain: The Royal Textile factory of Ezcarayt. *Accounting History* 6 (2): 59–90.
- Mascardi, V., V. Cordì, and P. Rosso. 2007. A Comparison of Upper Ontologies. In *WOA 2007: Agenti e Industria: Applicazioni tecnologiche degli agenti software.*, edited by M. Baldoni, A. Boccalatte, F. De Paoli, M. Martelli, and V. Mascardi, 55–64. Genova.
- Mattessich, R. 2013. *Reality and Accounting: Ontological Explorations in the Economic and Social Sciences*. New York: Routledge.

- McCartney, S., and A. J. Arnold. 2003. The railway mania of 1845-1847: Market irrationality or collusive swindle based on accounting distortions? *Accounting, Auditing & Accountability Journal* 16 (5): 831–852.
- . 2010. Financial reporting in the context of crisis: reconsidering the impact of the “mania” on early railway accounting. *European Accounting Review* 11 (2): 401–417.
- McGuinness, D. L. 2003. Ontologies come of age. In *Spinning the semantic web: bringing the World Wide Web to its full potential*, edited by D. Fensel, J. Hendler, H. Lieberman, and W. Wahlster, 1–14. First edit. MIT Press.
- McGuinness, D. L., and F. Van Harmelen. 2004. OWL web ontology language overview. *W3C recommendation* 10 (10): 1–22.
- Meerbote, R. 2001. Kant. In *A Companion to The Philosophers*, edited by R. L. Arrington, 338–351. 1st ed. Malden, Massachusetts: Blackwell Publishing Ltd.
- Mian, P. G., T. U. Conte, A. C. C. Natali, J. de A. Biolchini, and G. H. Travassos. 2005. A Systematic Review Process for Software Engineering. In *Proceedings of the 2nd Experimental Software Engineering Latin American Workshop (ESELAW’ 05)*. Brazil.
- Michie, R. C. 2008. *The Global Securities Market: A History*. 1st Pbk. Oxford: Oxford University Press.
- Mineau, G. W. 1993. The Term Definition Operators of Ontolingua and the Conceptual Graph Formalism: a Comparison. In *Conceptual Graphs for Knowledge Representation: First International Conference on Conceptual Structures, ICCS’93*, edited by G. W. Mineau, B. Moulin, and J. F. Sowa, 90–125. Quebec City, Canada.: Berlin : Springer.
- Miriam-Webster Dictionary. 2014. Ontology. <http://www.merriam-webster.com/dictionary/ontology>. Date accessed: 18/03/2014.
- . 2015. Concept. <http://www.merriam-webster.com/dictionary/concept>. Date accessed: 05/08/2015.
- Moonitz, M. 1963. Why do we need “postulates” and “principles.” *Journal of Accountancy* 116 (6): 42–46.
- . 1982. The Basic Postulates of Accounting (ARS 1). In *The Accounting Postulates and Principles Controversy of the 1960s.*, edited by S. A. Zeff. New York and London: Garland Publishing, Inc.
- Mumford, M. J. 1993. Users, characteristics and standards. In *Philosophical perspectives on accounting: Essays in Honour of Edward Stamp*, edited by M. J. Mumford and K. V. Peasnell, 7–29. London and New York: Routledge.
- Myers, M. D. 2013. *Qualitative Research in Business & Management*. 2nd ed. London: SAGE Publications, Ltd.

- Nardi, D., and R. J. Brachman. 2007. An Introduction to Description Logics. In *The Description Logics Handbook: Theory, Implementation and Applications*, edited by F. Baader, D. L. McGuinness, D. Nardi, and P. F. Patel-Schneider, 5–44. Second. Cambridge: Cambridge University Press.
- Neal, L. 2009. Natural experiments in financial reform in the nineteenth century: The Davis and Gallman analysis. In *The Origins and Development of Financial Markets and Institutions: From the Seventeenth Century to the Present*, edited by J. Attack and L. Neal, 241–261. Cambridge: Cambridge University Press.
- Neuhaus, F., A. Vizedom, K. Baclawski, M. Bennett, M. Dean, M. Denny, M. Gruninger, T. Longstreth, L. Obrst, S. Ray, R. Sriram, T. Schneider, M. Vegetti, M. West, and P. Yim. 2013. Towards Ontology Evaluation across the Life Cycle. *Applied Ontology* 8 (3): 179–194.
- Nida, E. A. 1969. Science of translation. *Language* 45 (3): 483–498.
- . 1981. Meaning vs. reference—The touchstone of lexicography. *Language Sciences* 3 (1): 51–57.
- . 1991. *Signs, sense, translation*. Bible Society of South Africa.
- Nida, E. A., and C. Taber. 2003. *The theory and practice of translation*. Leiden: Brill.
- Nobes, C. 1995. Major international differences in financial reporting. In *Comparative International Accounting*, edited by C. Nobes and R. Parker, 44–57. Fourth. New York: Prentice Hall.
- . 2005. Rules-based Standards and the Lack of Principles in Accounting. *Accounting Horizons* 19 (1): 25–34.
- Noy, N. F., and D. L. McGuinness. 2000. *Ontology Development 101: A Guide to Creating Your First Ontology*. Stanford, CA, 94305.
- O'Connor, M. J., and A. K. Das. 2011. A Method for Representing and Querying Temporal Information in OWL. In *Biomedical engineering systems and technologies*, edited by A. Fred, J. Filipe, and H. Gamboa, 127:97–110. Heidelberg: Springer-Verlag Berlin Heidelberg.
- Odlyzko, A. 2012. The Collapse of the Railway Mania, the Development of Capital Markets, and Robert Lucas Nash, a Forgotten Pioneer of Accounting and Financial Analysis. *SSRN Working Paper Series*.
- Okoli, C., and K. Schabram. 2010. A Guide to Conducting a Systematic Literature Review of Information Systems Research. *SSRN Electronic Journal*.
- Oldroyd, D. 1995. The role of accounting in public expenditure and monetary policy in the first century AD Roman Empire. *The Accounting Historians Journal* 22 (2): 117–129.

- OMG. 2008. Software & Systems Process Engineering Meta-Model Specification. <http://www.omg.org/technology/documents/formal/spem.htm>. Date accessed: 11/07/2014.
- . 2014. Object Management Group. www.omg.org. Date accessed: 11/07/2014.
- Oxford Dictionaries. 2015. Concept. <http://www.oxforddictionaries.com/definition/english/concept>. Date accessed: 05/08/2015.
- Palmer, S. B. 2001. *The Semantic Web: An Introduction*. *The CPA Journal*. Vol. 139. ACM Press.
- Partridge, C. 2002a. Shifting the ontological foundations of accounting's conceptual scheme. *BORO program, England, LADSEB-CNR, Padova Italy*.
- . 2002b. A new foundation for accounting: Steps towards the development of a reference ontology for accounting. *Technical Report 23/02, LADSEB-CNR, Padova, Italy*.
- Paton, W. A. 1922. *Accounting theory, with special reference to the corporate enterprise*. Ronald Press.
- Patterson, R. 2011. Aristotle. In *The Routledge Companion to Epistemology*, edited by S. Bernecker and D. Pritchard, 666–677. 1st ed. New York and London: Routledge.
- Peasnell, K. V. 1982. The Function of a Conceptual Framework for Corporate Financial Reporting. *Accounting and Business Research* 12 (48): 243–256.
- Peffers, K., T. Tuunanen, M. A. Rothenberger, A. Marcus, and S. Chatterjee. 2007. A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems* 24: 45–77.
- Peragallo, E. 1956. Origin of the Trial Balance. *The Accounting Review* 31 (3): 389–394.
- Persson, M. E., and C. J. Napier. 2013. Chambers and the AICPA'S Postulates and Principles Controversy: A Case of Vicarious Action. Oshkosh, WI, USA: Presented at the Academy of Accounting Historians Research Conference.
- Pike, B., and L. Chui. 2012. An evaluation of the FASB's Conceptual Framework from a user's perspective. *Academy of Accounting and Financial Studies* 16 (1): 77–94.
- Power, M. K. 1992. On the idea of a conceptual framework for financial reporting. In *Philosophical Perspectives on accounting: Essays in Honour of Edward Stamp*, edited by K. V. Mumford, M.J., Peasnell, 44–61. London and New York: Routledge.
- De Pree, C. M. 1989. Testing and Evaluating a Conceptual Framework of Accounting. *Abacus* 25 (2): 61 – 73.
- Rector, A., N. Drummond, M. Horridge, J. Rogers, H. Knublauch, R. Stevens, H. Wang, and C. Wroe. 2004. OWL Pizzas: Practical Experience of Teaching OWL-DL: Common Errors &

- Common Patterns. In *Engineering Knowledge in the Age of the Semantic Web*, 63–81. Springer Berlin Heidelberg.
- Reinhart, C. M., and K. Rogoff. 2009. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton, New Jersey: Princeton University Press.
- Riahi-Belkaoui, A. 2004. *Accounting theory*. London: International Thomson Business.
- Roberts, T. C. 1987. The American Association of Public Accountants (1908). *The Accounting Historians Journal* 14 (2): 103–107.
- Rothman, M. S. 2004. Studying the Development of Complex Society: Mesopotamia in the Late Fifth and Fourth Millennia BC. *Journal of Archaeological Research* 12 (1): 75–119.
- Russell, B. 1970. The World of Universals. In *Universals and Particulars: Readings in Ontology*, edited by M. J. Loux, 16–23. New York: Ancor Books, Doubleday & Company Inc.
- Ryan, B., R. W. Scapens, and M. Theobald. 2002. *Research Method and Methodology in Finance and Accounting*. 2nd ed. London: Thomson Learning.
- Salvary, S. C. W. 1979. Tracing the Development of a Conceptual Framework of Accounting a Western European and North American Linkage: A Partial Examination. *SSRN Electronic Journal*. The Academy of Accounting Historians: 36.
- Sangster, A., G. N. Stoner, and P. A. McCarthy. 2008. The Market for Luca Pacioli's Summa Arithmetica. *The Accounting Historians Journal* 35 (1): 111–134.
- Saunders, M., P. Lewis, and A. Thornhill. 2012. *Research Methods for Business Students*. 6th ed. Harlow, England: Pearson Education Limited.
- Schipper, K. 2003. Principles-based accounting standards. *Accounting Horizons* 17 (1): 61.
- Schmandt-Besserat, D. 1989. Two Precursors of Writing: Plain and Complex Tokens. In *The Origins of Writing*, edited by W. M. Senner, 27–42. Lincoln and London: University of Nebraska Press.
- Schneider, L. 2010. Revisiting the Ontological Square. *Formal Ontology in Information Systems* 209: 73–86.
- Sebestik, J. 2014. Bolzano's Logic. Ed. E. N. Zalta. *The Stanford Encyclopaedia of Philosophy*. Stanford: Stanford.
- Senner, W. M. 1989. Theories and Myths on the Origins of Writing: A Historical Overview. In *The Origins of Writing*, edited by W. M. Senner, 1–26. Lincoln and London: University of Nebraska Press.
- Simon, J., M. Dos Santos, J. Fielding, and B. Smith. 2006. Formal ontology for natural language processing and the integration of biomedical databases. *International Journal of Medical Informatics* 75 (3-4): 224–231.

- Simpson, S. G. 2000. Logic and Mathematics. In *The Philosopher's Handbook: Essential Readings from Plato to Kant*, edited by S. Rosen, 577–606. First Edit. New York: Random House Reference.
- Smith, B. 1989. Logic and Formal Ontology. In *Husserl's Phenomenology: A Textbook*, edited by J. N. Mohanty and W. McKenna, 29–67. Lanham: University Press of America.
- . 1998. The Basic Tools of Formal Ontology. Ed. N. Guarino. *Formal Ontology in Information Systems* 181 (2): 19–28.
- . 2003. Ontology. In *Blackwell Guide to the Philosophy of Computing and Information*, edited by L. Floridi, 155–166. Oxford: Blackwell Publishing Ltd.
- Smith, B., and W. Ceusters. 2005. Ontology as the Core Discipline of Biomedical Informatics: Legacies of the Past and Recommendations for the Future Direction of Research. *Computing, Philosophy, and Cognitive Science*. 35 (12): 26–26.
- . 2010. Ontological realism: A methodology for coordinated evolution of scientific ontologies. *Applied Ontology* 5 (Number 3-4/2010): 139–188.
- Soderstrom, N. S., and K. J. Sun. 2007. IFRS Adoption and Accounting Quality: A Review. *European Accounting Review* 16 (4): 675–702.
- Sowa, J. F., and T. Search. 2010. *Theory and Applications of Ontology: Philosophical Perspectives*. Ed. R. Poli and J. Seibt. Dordrecht: Springer Netherlands.
- Spies, M. 2010. An ontology modeling perspective on business reporting. *Information Systems* 35 (4): 404–416.
- Sprague, C. 1907. *The philosophy of accounts*. Kansas, US: Scholars Books.
- Sprouse, R. T., and M. Moonitz. 1982. A Tentative set of Broad Accounting Principles for Business Enterprises. (ARS 3). In *The Accounting Postulates and Principles Controversy of the 1960s.*, edited by S. A. Zeff. New York and London: Garland Publishing, Inc.
- Stamp, E. 1970. Establishing Accounting Principles. *Abacus* 6 (2): 96–104.
- . 1980. *Corporate Reporting: Its Future Evolution*. Toronto.
- Stearns, P. N. 2005. *World History in Brief: Major Patterns of Change and Continuity*. Fifth Edit. New York, NY, USA: Pearson Education, Inc. =.
- Stein, K. M. 2015. International Cooperation in a New Data-Driven World. *U.S. Securities and Exchange Commission*. http://www.sec.gov/news/speech/2015-spch032615kms.html?Reference_ID=36959778#.VSZJmfVhLhx. Date accessed: 09/04/2015.
- Stone, A. 2005. After Sarbanes-Oxley, XBRL? *Business Week Online*: N.PAG.

- Storey, R. K., and S. Storey. 1998. *The Framework of Financial Accounting Concepts and Standards*. Norwalk, Connecticut: Financial Accounting Standards Board.
- Strayer, J. R. 1956. Feudalism in Western Europe. In *Feudalism in History*, edited by R. Coulborn, 15–25. Princeton, New Jersey: Princeton University Press.
- Street, D. L. 1996. A recent history of financial reporting in the UK and US. In *Accounting History from the Renaissance to the Present: A Remembrance of Luca Pacioli*, edited by T. A. Lee, A. Bishop, and R. H. Parker, 71–118. New York and London: Garland Publishing, Inc.
- Stroud, R. S. 1989. The Art of Writing in Ancient Greece. In *The Origins of Writing*, edited by Senner Wayne M., 103–119. Lincoln and London: University of Nebraska Press.
- Sugumaran, V., and V. C. Storey. 2002. Ontologies for conceptual modeling: their creation, use, and management. *Data & Knowledge Engineering* 42 (3): 251–271.
- Sylla, R. 2009. Comparing the UK and US financial systems, 1790-1830. In *The Origins and Development of Financial Markets and Institutions: From the Seventeenth Century to the Present*, edited by J. Attack and L. Neal, 209–241. Cambridge: Cambridge University Press.
- Teller, P. 2008. The use of a formal representation of accounting standards. *International Journal of Computer Science and Applications* 5 (3b): 93–116.
- Thomas, J., and A. Harden. 2008. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC medical research methodology* 8 (1): 45.
- Toutain, J. 1930. *The Economic Live of the Ancient World*. London: Kegan Paul, Trench, Trubner & Co., LTD.
- Trueblood, R. M., R. M. Cyert, S. Davidson, J. D. Edwards, O. S. Gellein, C. R. Parker, A. J. Reinhart, H. O. Wagner, and F. T. Weston. 1973. *Objectives of Financial Statements (Trueblood Report)*. Chicago, Illinois.
- Tweedie, D. 2007. Can Global Standards Be Principle Based? *Journal of Applied Research in Accounting and Finance* 2 (1). *Journal of Applied Research in Accounting and Finance*: 3–8.
- Uschold, M., and M. Gruninger. 2004. Ontologies and semantics for seamless connectivity. *ACM SIGMOD Record* 33 (4): 58–64.
- Vaishnavi, V., and W. Kuechler. 2013. Design Science Research in Information Systems. *Association for Information Systems*. <http://design-research-in-informationsystems>. Date accessed: 07/08/2015.
- Vance, L. L. 1944. Current Problems and Accounting Theory. *Accounting Review* 19 (3): 231–238.
- Vatter, W. J. 1947. *The Fund Theory of Accounting and its Implications for Financial Reports*. University of Chicago Press.

- Venable, J., J. Pries-Heje, and R. Baskerville. 2014. FEDS: a Framework for Evaluation in Design Science Research. *European Journal of Information Systems*: 1–13.
- W3C. 2012. OWL 2 Web Ontology Language: Document Overview (Second Edition). *W3C Recommendation*. <http://www.w3.org/TR/owl2-overview/>. Date accessed: 03/08/2014.
- Wallerstein, I. 1980. *The Modern World-System II: Mercantilism and the Consolidation of the European World-Economy, 1600-1750*. London: Academic Press.
- Wand, Y., V. Storey, and R. Weber. 1999. An ontological analysis of the relationship construct in conceptual modeling. *ACM Transactions on Database Systems* 24 (4): 494–528.
- Wand, Y., and R. Weber. 2002. Research Commentary: Information Systems and Conceptual Modeling—A Research Agenda. *Information Systems Research* 13 (4): 363–376.
- Wang, H., and M. L. Schagrin. 2014. Metalogic. *Encyclopaedia Britannica Online*. Encyclopaedia Britannica Inc.
- Watts, R. L. 1982. Discussion of the use of mathematical models in financial accounting. *Journal of Accounting Research* 20: 48–55.
- Watts, R. L., and J. L. Zimmerman. 1979. The Demand for and Supply of Accounting Theories: The Market for Excuses. *The Accounting Review* 54 (2): 273–305.
- Whittington, G. 2008a. Fair value and the IASB/FASB conceptual framework project: an alternative view. *Abacus* 44 (2): 139–168.
- . 2008b. Harmonisation or discord? The critical role of the IASB conceptual framework review. *Journal of Accounting and Public Policy* 27 (6): 495–502.
- Whittow, M. 2010. The Middle Byzantine Economy (600-1204). In *The Cambridge History of the Byzantine Empire c.500–1492*, edited by J. Shepard, 465–492. Cambridge: Cambridge University Press.
- Wieringa, R. 2011. Real-World Semantics of Conceptual Models. In *The Evolution of Conceptual Modeling: From a Historical Perspective towards the Future of Conceptual Modeling*, edited by R. Kaschek and L. Delcambre, 1–20. Berlin, Heidelberg: Springer Berlin Heidelberg.
- Wilmont, I., S. Hengeveld, E. Barendsen, and S. Hoppenbrouwers. 2013. Cognitive Mechanisms of Conceptual Modeling. In *Conceptual Modeling*, 74–87. Berlin, Heidelberg: Springer Berlin Heidelberg.
- Wolk, H. I., J. L. Dodd, and J. J. Rozycki. 2013. *Accounting theory: Conceptual Issues in a Political and Economic Environment*. Eighth. London: SAGE Publications, Inc.
- Wolterstorff, N. 1970. *On Universals : An Essay in Ontology*. Chicago, USA: The University of Chicago Press.

- Wu, X. 2013. Enhancing Ontology Matching using Logic-based Reasoning. Master of Science (M.Sc.). Technische Universität Dresden.
- Wukitsch, T. K. 2014. The Medieval Legacy. <http://www.mmdtkw.org/RenRomUnit0100-0PixList.html>. Date accessed: 03/04/2014.
- Wüstemann, J., and S. Wüstemann. 2010. Why Consistency of Accounting Standards Matters: A Contribution to the Rules-Versus-Principles Debate in Financial Reporting. *Abacus* 46 (1): 1–27.
- Zeff, S. A. 1982. *The Accounting postulates and principles controversy of the 1960s*. Ed. S. A. Zeff. New York: Garland Publishers.
- . 1991. *American Accounting Association: its first 50 years, 1916-1966*. Sarasota, FL: American Accounting Association.
- . 1999. The evolution of the conceptual framework for business enterprises in the United States. *The Accounting Historians Journal* 26 (2): 89–131.
- . 2002. Political lobbying on proposed standards: A challenge to the IASB. *Accounting Horizons* 16 (1).
- . 2012. Development of Accounting Standards. In *Handbook of Key Global Financial Markets, Institutions, and Infrastructure.*, edited by G. Caprio. First. Academic Press.
- Zeff, S. A., S. Enevoldsen, and R. Hodgkinson. 2013. Discussion of “The objectives of financial reporting: A historical survey and analysis” by Stephen Zeff (2013). *Accounting and Business Research* 43 (4): 328–328.
- Zúñiga, G. L. 2001. Ontology: Its Transformation From Philosophy to Information Systems. In *Proceedings of the international conference on Formal Ontology in Information Systems - FOIS '01*, 2001:187–197. New York, USA: ACM Press.

12 APPENDICES

12.1 Appendix A – Some Major World Crises in the Twentieth and Twenty-first Centuries

A discussion of some of the major world crises in the twentieth and twenty-first centuries is included in a separate document in the CD accompanying this document.

12.2 Appendix B – Major Corporate Collapses

A discussion on the major corporate collapses is included in a separate document in the CD accompanying this document.

12.3 Appendix C – List of Stock Market Crashes and Bear Markets

The List of stock market crashes and bear markets is included in a separate document in the CD accompanying this document.

12.4 Appendix D – CFfFR Working Document

The CFfFR working document is included in a separate document in the CD accompanying this document.

12.5 Appendix E – Ontology Engineering Decisions

1. Ontology Engineering Decisions

The ontology is constructed with two major inputs from the CFfFR:

- a. the elements or entities and the relationships between them that informs the construction of financial reports;
- b. the competency questions that informs the design of the ontology and the purpose / objectives of the ontology.

2. Ontology classes, assertions and notes

Class Name	Assertion	Note / Reference
Benefit	<ul style="list-style-type: none"> is_a type of Thing 	
EconomicBenefit	<ul style="list-style-type: none"> is_a type of Benefit 	
FutureEconomicBenefit	<ul style="list-style-type: none"> is_a type of EconomicBenefit happenIn some FutureTemporalInterval 	<p>4.10. The future economic benefits embodied in an asset may flow to the entity in a number of ways. For example, an asset may be:</p> <p>(a) used singly or in combination with other assets in the production of goods or services to be sold by the entity;</p> <p>(b) exchanged for other assets;</p> <p>(c) used to settle a liability; or</p> <p>(d) distributed to the owners of the entity.</p> <p>4.8. The future economic benefit embodied in an asset is the potential to contribute, directly or indirectly, to the flow of cash and cash equivalents to the entity.</p>
ExpectedFutureEconomicBenefit (EFEB)	<ul style="list-style-type: none"> is_a type of FutureEconomicBenefit is_a type of expectedBy some Entity happenIn some FutureTemporalInterval 	
Claim	<ul style="list-style-type: none"> is_a type of Thing 	Claim is not defined in the CFfFR, but Claim was identified as one of only two main classes on the Statement of Financial Position. The other main class is Asset.
Obligation	<ul style="list-style-type: none"> is_a type of Claim has-Settlement some Settlement 	

Class Name	Assertion	Note / Reference
PresentObligation	<ul style="list-style-type: none"> • is- a type of Obligation • isValidOnDate some PresentReportingDate • hasSettlement some Settlement 	
Liability	<ul style="list-style-type: none"> • is Equivalent to PresentObligation and (hasSettlement some ExpectedSettlement) • hasLiabilityValue some decimal • isValidOnDate some PresentReportingDate • hasSettlement some Settlement • is Disjoint With Asset 	<p>CFfFR p. A34: 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.</p> <p>A liability is a present obligation, owed by the entity to transfer the control of an asset, which is a result of past events</p>
Equity	<ul style="list-style-type: none"> • is_a type of Claim • is Equivalent to ResidualValue 	<p>CFfFR p.A35: Equity is the residual interest in the assets of the entity after deducting all its liabilities.</p> <p>Our developed definition: Equity is a shareholders' claim against the entity that is the result of past events, and which is not a present obligation</p>
Control	<ul style="list-style-type: none"> • is_a type of Thing 	
ResourceControl	<ul style="list-style-type: none"> • is_a type of Control • IsControlOf some Entity 	<p>3.23 - The IASB proposes to use the same basic concepts to define control of an economic resource in the CFfFR. It proposes the following definition: An entity controls an economic resource if it has the present ability to direct the use of the economic resource so as to obtain the economic benefits that flow from it.</p>
Element	<ul style="list-style-type: none"> • is_a type of Thing 	
FinancialStatementElement	<ul style="list-style-type: none"> • is_a type of Element • is-Equivalent To MeasurementOfFinancialPositionElement or MeasurementOfPerformanceElement 	<p>The CFfFR states "Financial statements portray the financial effects of transactions and other events by grouping them into broad classes according to their economic characteristics. These broad classes are termed the elements of financial statements. The elements directly related to the measurement of financial position in the balance sheet are assets, liabilities</p>

Class Name	Assertion	Note / Reference
		and equity. The elements directly related to the measurement of performance in the income statement are income and expenses. The statement of changes in financial position usually reflects income statement elements and changes in balance sheet elements; accordingly, this Conceptual Framework identifies no elements that are unique to this statement."
MeasurementOfFinancialPositionElement	<ul style="list-style-type: none"> • is_a type of FinancialStatementElement • is-Disjoint With MeasurementOfPerformanceElement 	
AssetElement	<ul style="list-style-type: none"> • is_a type of MeasurementOfFinancialPositionElement 	
EquityElement	<ul style="list-style-type: none"> • is_a type of MeasurementOfFinancialPositionElement 	
LiabilityElement	<ul style="list-style-type: none"> • is_a type of MeasurementOfFinancialPositionElement 	
MeasurementOfPerformanceElement	<ul style="list-style-type: none"> • is_a type of FinancialStatementElement • is-Disjoint With MeasurementOfFinancialPositionElement 	
ExpenseElement	<ul style="list-style-type: none"> • is_a type of MeasurementOfPerformanceElement 	<p>CFfFR A38: Expenses are decreases in economic benefits during the accounting period in the form of outflows or depletions of assets or incurrences of liabilities that result in decreases in equity, other than those relating to distributions to equity participants.</p> <p>Choose to model according to the definition of income that is another mechanism to interpret the "values" of assets, liabilities.</p>
IncomeElement	<ul style="list-style-type: none"> • is_a type of MeasurementOfPerformanceElement 	<p>CFfFR A38: 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</p>

Class Name	Assertion	Note / Reference
		<p>from equity participants.</p> <p>Choose to model according to the definition of income that is another mechanism to interpret the “values” of assets, liabilities.</p>
Entity	<ul style="list-style-type: none"> • is_a type of Thing • hasFinancialPosition some FinancialPosition • hasInformation some EntityInformation • hasManagement some Management • hasObligation some Obligation • hasTypeOfControl some Control • hasFinancialPerformance some FinancialPerformance 	Entity - most general description of social construct that prepare and present financial statements
ReportingEntity	<ul style="list-style-type: none"> • is_a type of Entity • is_a type of publishFinancialReport some FinancialReport • hasFinancialPosition some FinancialPosition • hasInformation some EntityInformation • hasManagement some Management • hasObligation some Obligation • hasTypeOfControl some Control 	<p>Entity - most general description of social construct that prepare and present financial statements</p> <p>The chapter on the Reporting Entity in the CFfFR is still outstanding.</p> <p>The information in the CFfFRO was obtained by analysing a financial report.</p>
RegisteredReportingEntity	<ul style="list-style-type: none"> • is_a type of ReportingEntity • is_a type of hasRegistrationNumber some string • is_a type of publishFinancialReport some FinancialReport • hasFinancialPosition some FinancialPosition • hasInformation some EntityInformation • hasManagement some Management • hasObligation some Obligation • hasTypeOfControl some Control 	<p>Entities registered according to legal requirements.</p> <p>The information in the CFfFR was obtained by analysing a financial report.</p>
FinancialPosition	<ul style="list-style-type: none"> • is_a type of Thing • is_a type of isReportedOnBy some 	

Class Name	Assertion	Note / Reference
	StatementOfFinancialPosition	
Information	<ul style="list-style-type: none"> is_a type of Thing 	<p>Used to capture the “other information” other than statements that is part of a financial report, such as information about the entity or “notes to statements”.</p> <p>This is a very vague class at present but it is mentioned prominently within the CFfFR.</p>
EntityInformation	<ul style="list-style-type: none"> is_a type of Information 	Under EntityInformation is categorised all additional entity information included in financial reports e.g. biographical information, legal status, management information, statement of responsibility, reports of the independent auditor and report of the directors etc.
FinancialStatementInformation	<ul style="list-style-type: none"> is_a type of Information 	This class includes all additional information to financial statements in financial reports.
NotesToFinancialStatements	<ul style="list-style-type: none"> is_a type of FinancialStatementInformation hasStatementDate some PresentReportingDate hasTimePeriod some PastReportingPeriod 	This is the notes to financial statements that are included in financial reports.
Instrument	<ul style="list-style-type: none"> is_a type of Thing 	
DebtInstrument	<ul style="list-style-type: none"> is_a type of Instrument 	
EquityInstrument	<ul style="list-style-type: none"> is_a type of Instrument 	
Management	<ul style="list-style-type: none"> is_a type of Thing is Equivalent To GoverningBoard or Management 	OB4 - according to footnote 2 of the CFfFR management refers to management and the governing board of an entity.
Board	<ul style="list-style-type: none"> is_a type of Management is_a type of GoverningBoard or Management 	
GoverningBoard	<ul style="list-style-type: none"> is_a type of Board is_a type of GoverningBoard or Management 	
Report	<ul style="list-style-type: none"> is-type of Thing 	
FinancialReport	<ul style="list-style-type: none"> is_a type of Report hasFinancialReportDate some PresentReportingDate hasReportPart some EntityInformation hasReportPart some FinancialStatement hasReportPart some NotesToFinancialStatements 	Even though the concepts “financial statement” and “financial report” are used as synonyms in the CFfFR, there are distinct differences. Financial statements can exist separate from a financial report

Class Name	Assertion	Note / Reference
	<ul style="list-style-type: none"> hasTimePeriod some PastReportingPeriod 	<p>e.g. cash flow statement. A financial report always contains a set of financial statements so the PartOf relationship holds.</p> <p>The FinancialReportDate is the present reporting date, which is the end date of the past reporting period. This is the date printed on the title of the financial report.</p> <p>This information was obtained from a financial report and is not mentioned in the CFfFR thus an indication of some incompleteness in the CFfFR.</p>
AnnualFinancialReport	<ul style="list-style-type: none"> is_a type of FinancialReport hasTimePeriod some PastFinancialYear hasReportPart some EntityInformation hasReportPart some FinancialStatement hasReportPart some NotesToFinancialStatements hasTimePeriod some PastReportingPeriod hasFinancialReportDate some PresentReportingDate 	<p>This is the final year-end financial report that has to be approved.</p> <p>This information was obtained from a financial report and is not mentioned in the CFfFR thus an indication of some incompleteness in the CFfFR.</p>
Resource	<ul style="list-style-type: none"> is_a type of Thing 	
ControlledResource	<ul style="list-style-type: none"> is_a type of Resource is Equivalent To EconomicResource is_a type of isControlledBy some Control 	
EconomicResource	<ul style="list-style-type: none"> is_a type of Resource is Equivalent To ControlledResource is_a type of isControlledBy some Control 	
Asset	<ul style="list-style-type: none"> is Equivalent To ControlledResource and (fromWhichInflow some EFEB) is_a type of hasAssetValue some decimal is_a type of ControlledResource is_a type of EconomicResource is_a type of isControlledBy some Control is Disjoint With Liability 	<p>From CFfFR p. A34: 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.</p> <p>Many assets, for example, property, plant and equipment, have a physical form. However, physical form is not essential to the existence of an asset; hence patents and copyrights, for example, are assets if future economic benefits are expected to</p>

Class Name	Assertion	Note / Reference
		flow from them to the entity and if they are controlled by the entity.
Responsibility	<ul style="list-style-type: none"> is_a type of Thing 	
MangementResponsibility	<ul style="list-style-type: none"> is_a type of Responsibility 	
Settlement	<ul style="list-style-type: none"> is_a type of Thing 	<p>A definition of settlement in the CFfFR is needed.</p> <p>This is an indication of an omission of a basic concepts in the CFfFR.</p>
ExpectedSettlement	<ul style="list-style-type: none"> is_a type of Settlement is_a type of and (expectedBy some Entity) 	
Statement	<ul style="list-style-type: none"> is_a type of Thing 	<p>The class Statement is not defined in the CFfFRO. The assertion of Statement and the sub classes of Statement was obtained from an example of a financial report.</p> <p>The class Statement is essential in the CFfFRO in order to comply with the competency question to provide decision-useful information to the users of financial reports.</p> <p>This is an indication of an omission of a basic class in the CFfFR.</p>
FinancialStatement	<ul style="list-style-type: none"> is_a type of Statement hasElement some FinancialStatementElement hasStatementDate some PresentReportingDate 	
StatementOfCashFlows	<ul style="list-style-type: none"> is_a type of FinancialStatement hasTimePeriod some PastReportingPeriod hasStatementDate some PresentReportingDate hasElement some FinancialStatementElement 	
StatementOfChangesInEquity	<ul style="list-style-type: none"> is_a type of FinancialStatement hasTimePeriod some PastReportingPeriod hasStatementDate some PresentReportingDate hasElement some FinancialStatementElement 	
StatementOfFinancialPosition	<ul style="list-style-type: none"> is_a type of FinancialStatement hasElement some MeasurementOfFinancialPositionElement hasStatementDate some PresentReportingDate 	Same as Balance sheet still mentioned in the current CFfFR

Class Name	Assertion	Note / Reference
	<ul style="list-style-type: none"> hasElement some FinancialStatementElement 	
StatementOfProfitOrLossAndOtherComprehensiveIncome	<ul style="list-style-type: none"> is_a type of FinancialStatement hasTimePeriod some PastReportingPeriod hasStatementDate some PresentReportingDate hasElement some FinancialStatementElement 	Equivalent to Income Statement as referred to in the current CFFR
TemporalConcept	<ul style="list-style-type: none"> is_a type Thing is Equivalent To TemporalInstant or TemporalInterval 	<p>The class TemporalClass is not defined in the CFFR. The assertion of TemporalClass and the sub classes of TemporalClass was obtained from an example of a financial report.</p> <p>The class TemporalClass is essential in the CFFRO in order to comply with the competency question to provide decision-useful information to the users of financial reports.</p> <p>This is an indication of an omission of a basic concept in the CFFR.</p>
TemporalInstant	<ul style="list-style-type: none"> is_a type of TemporalInstant or TemporalInterval Disjoint With TemporalInterval 	A temporal instant is an exact instance in time - for financial reporting purposes this is exactly the end of a date e.g. 23:59:59 on a specific date such as 31/3/2015.
ConsiderationDate	<ul style="list-style-type: none"> is_a type of TemporalInstant or TemporalInterval 	
ReportingDate	<ul style="list-style-type: none"> is_a type of TemporalInstant or TemporalInterval 	
FutureReportingDate	<ul style="list-style-type: none"> is_a type of ReportingDate is_a type of TemporalInstant or TemporalInterval Disjoint With PastReportingDate, PresentReportingDate 	
PastReportingDate	<ul style="list-style-type: none"> is_a type of ReportingDate is_a type of TemporalInstant or TemporalInterval Disjoint With FutureReportingDate, PresentReportingDate 	
PresentReportingDate	<ul style="list-style-type: none"> is_a type of ReportingDate is_a type of TemporalInstant or TemporalInterval Disjoint With FutureReportingDate, PastReportingDate Disjoint With PastTemporalInterval, FutureTemporalInterval 	
TemporalInterval \equiv TimePeriod	<ul style="list-style-type: none"> Equivalent to TimePeriod 	

Class Name	Assertion	Note / Reference
	<ul style="list-style-type: none"> • is_a type of temporalBegins some TemporalInstant • is_a type of TemporalConcept • is_a type of temporalEnds some TemporalInstant • is_a type of TemporalInstant or TemporalInterval • Disjoint With TemporalInstant 	
FutureTemporalInterval	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of TemporalInterval • is_a type of TemporalInstant or TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a temporalEnds some TemporalInstant • Disjoint With PresentReportingDate, PastTemporalInterval 	
FutureReportingPeriod	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of ReportingPeriod • is_a type of TemporalInterval • is_a type of FutureTemporalInterval • is_a type of TemporalInstant or TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a temporalEnds some TemporalInstant 	
CurrentFutureReportingPeriod	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of FutureReportingPeriod • is_a type of TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a temporalEnds some TemporalInstant • is_a type of TemporalInstant or TemporalInterval • is_a type of temporalBegins some PresentReportingDate • is_a temporalEnds some FutureReportingDate • is_a type of temporalBegins some TemporalInstant • is_a temporalEnds some TemporalInstant 	This is the financial reporting period between the present reporting date and the future reporting date
LongtermFutureReportingPeriod	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of FutureReportingPeriod • is_a type of TemporalInterval • is_a type of temporalBegins some FutureReportingDate or PresentReportingDate) • is_a type of TemporalInstant or TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a temporalEnds some TemporalInstant 	

Class Name	Assertion	Note / Reference
	<ul style="list-style-type: none"> Disjoint With CurrentFutureReportingPeriod 	
PastTemporalInterval	<ul style="list-style-type: none"> is_a type of TimePeriod is_a type of TemporalInterval is_a type of TemporalInstant or TemporalInterval is_a type of temporalBegins some TemporalInstant is_a temporalEnds some TemporalInstant Disjoint With PresentReportingDate, FutureTemporalInterval 	
PastReportingPeriod	<ul style="list-style-type: none"> is_a type of TimePeriod is_a type of ReportingPeriod is_a type of PastTemporalInterval is_a type of temporalBegins some PastReportingDate is_a type of temporalEnds some PresentReportingDate is_a type of TemporalInstant or TemporalInterval is_a type of TemporalInterval is_a type of temporalBegins some TemporalInstant is_a temporalEnds some TemporalInstant 	
PastFinancialYear	<ul style="list-style-type: none"> is_a type of TimePeriod is_a type of PastReportingPeriod is_a type of temporalBegins some PastReportingDate is_a type of temporalEnds some PresentReportingDate is_a type of TemporalInstant or TemporalInterval is_a type of TemporalInterval is_a type of temporalBegins some TemporalInstant is_a type of temporalEnds some TemporalInstant 	
ReportingPeriod	<ul style="list-style-type: none"> is_a type of TimePeriod is_a type of TemporalInstant or TemporalInterval is_a type of TemporalInterval is_a type of temporalBegins some TemporalInstant is_a type of temporalEnds some TemporalInstant 	
FutureReportingPeriod	<ul style="list-style-type: none"> is_a type of TimePeriod is_a type of FutureTemporalInterval is_a type of ReportingPeriod is_a type of TemporalInstant or TemporalInterval is_a type of TemporalInterval is_a type of temporalBegins some TemporalInstant is_a type of temporalEnds some TemporalInstant 	
CurrentFutureReportingPeriod	<ul style="list-style-type: none"> is_a type of TimePeriod 	

Class Name	Assertion	Note / Reference
	<ul style="list-style-type: none"> • is_a type of FutureReportingPeriod • is_a type of temporalBegins some PresentReportingDate • is_a type of temporalEnds some FutureReportingDate • is_a type of TemporalInstant or TemporalInterval • is_a type of TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a type of temporalEnds some TemporalInstant 	
LongtermFutureReportingPeriod	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of FutureReportingPeriod • is_a type of temporalBegins some (FutureReportingDate or PresentReportingDate) • is_a type of TemporalInstant or TemporalInterval • is_a type of TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a type of temporalEnds some TemporalInstant 	
PastReportingPeriod	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of PastTemporalInterval • is_a type of ReportingPeriod • is_a type of temporalBegins some PastReportingDate • is_a type of temporalEnds some PresentReportingDate • is_a type of TemporalInstant or TemporalInterval • is_a type of TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a type of temporalEnds some TemporalInstant 	
PastFinancialYear	<ul style="list-style-type: none"> • is_a type of TimePeriod • is_a type of PastReportingPeriod • is_a type of temporalBegins some PastReportingDate • is_a type of temporalEnds some PresentReportingDate • is_a type of TemporalInstant or TemporalInterval • is_a type of TemporalInterval • is_a type of temporalBegins some TemporalInstant • is_a type of temporalEnds some TemporalInstant 	
TimePeriod \equiv TemporalInterval	<ul style="list-style-type: none"> • Equivalent To TemporalInterval • is_a type of TemporalConcept • is_a type of TimePeriod • is_a type of TemporalInstant or TemporalInterval • is_a type of temporalBegins some TemporalInstant 	

Class Name	Assertion	Note / Reference
	<ul style="list-style-type: none"> is_a type of temporalEnds some TemporalInstant 	
User	<ul style="list-style-type: none"> is_a type of Thing 	
ExternalUser	<ul style="list-style-type: none"> is_a type of User 	User external to entity that uses financial statements.
Creditor	<ul style="list-style-type: none"> is_a type of ExternalUser 	OB2: PotentialCreditor, ExistingCreditor. PotentialCreditor is not an ExistingCreditor (disjoint)
ExistingCreditor	<ul style="list-style-type: none"> is_a type of Creditor Disjoint With PotentialCreditor 	
PotentialCreditor	<ul style="list-style-type: none"> is_a type of Creditor Disjoint With ExistingCreditor 	
Lender	<ul style="list-style-type: none"> is_a type of Creditor 	OB2: A Lender is a Creditor Two types: PotentialLender, ExistingLender PotentialLender is not a ExistingLender (disjoint)
ExistingLender	<ul style="list-style-type: none"> is_a type of Lender Disjoint with PotentialLender 	
PotentialLender	<ul style="list-style-type: none"> is_a type of Lender Disjoint with ExistingLender 	
Investor	<ul style="list-style-type: none"> Equivalent To ExistingInvestor or PotentialInvestor Is-a type of ExternalUser 	OB2: PotentialInvestor, ExistingInvestor PotentialInvestor is not a ExistingInvestor (disjoint)
ExistingInvestor	<ul style="list-style-type: none"> is_a type of Investor is_a type of ExistingInvestor or PotentialInvestor Disjoint With PotentialInvestor 	
PotentialInvestor	<ul style="list-style-type: none"> is_a type of Investor is_a type of ExistingInvestor or PotentialInvestor Disjoint With ExistingInvestor 	
Shareholder	<ul style="list-style-type: none"> is_a type of User 	
Value	<ul style="list-style-type: none"> is_a type of Thing 	To be recognised, an item meets the definition of an element and has cost or value that can be measured with reliability, CffFR par 4.38 p.A40
ResidualValue \equiv Equity	<ul style="list-style-type: none"> Equivalent To Equity is_a type of Value is_a type of ResidualValue 	
TotalAssetValue	<ul style="list-style-type: none"> is_a type of Value 	Sum value of all asset values
TotalLiabilityValue	<ul style="list-style-type: none"> is_a type of Value 	Sum value of all liability values

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The Conceptual Framework for Financial Reporting Represented in a Formal Language

by

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Dissertation presented in fulfilment of the requirements for the degree

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in the

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

at the

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15 September 2015

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12 APPENDICES

12.1 Appendix A - Some of the Major World Crises in the Twentieth and Twenty-first Centuries

- Wall Street Crash of 1929, followed by the Great Depression – the largest and most important economic depression in the 20th century
- 1973–1973 oil crisis – oil prices soared, causing the 1973–1974 stock market crash
- Secondary banking crisis of 1973–1975 – United Kingdom
- 1987 – Black Monday (1987) – the largest one-day percentage decline in stock market history
- 1989–91 – United States Savings & Loan crisis
- 1990 – Japanese asset price bubble collapsed
- Early 1990s recession
- 1992–93 – Black Wednesday – speculative attacks on currencies in the European Exchange Rate Mechanism
- 1997–98 – 1997 Asian Financial Crisis – devaluations and banking crises across Asia
- 1998 Russian financial crisis
- 2000 – early 2000s recession
- 1999-2002 – Argentine economic crisis (1999-2002)
- 2001 – Bursting of dot.com bubble – speculations concerning internet companies crashed
- 2007–08 – Global financial crisis
- 2010 European sovereign debt crisis

Source (Wikipedia, 2014a)

12.2 Appendix B – Major Corporate Collapses

Name	Date	Business	Causes
Medici Bank	1494	Banking	Owned by the Medici family, it ran up large debts due to the family's profligate spending, extravagant lifestyle, and failure to control the managers, their bank went insolvent.
South Sea Company	Sep 1720	Slavery and colonialism	After the War of Spanish Succession, the UK signed the Treaty of Utrecht 1713 with Spain, ostensibly allowing it to trade in the seas near South America. In fact, barely any trade took place as Spain renounced the Treaty, however this was concealed on the UK stock market. A speculative bubble saw the share price reach over £1000 in August 1720, but then crash in September. A Parliamentary inquiry revealed fraud among members of the government, including the Tory Chancellor of the Exchequer John Aislabie, who was sent to prison.
Mississippi Company	Sep 1720	Colonialism	Scottish economist John Law convinced the French government to support a monopoly trade venture in Louisiana. He marketed shares based on great wealth, which was highly exaggerated. A speculative bubble grew and then collapsed, and Law was expelled.
Overend, Gurney & Co	June 1866	Banking	After Samuel Gurney's retirement, the bank invested heavily in railway stocks. It went public in 1865, but was badly affected by a general fall in stock prices. The Bank of England refused to advance money, and it collapsed. The directors were sued, but exonerated from fraud.
Friedrich Krupp AG	1873	Steel, metals	Krupp's business over-expanded, and had to take a 30m Mark loan from the Preußische Bank, the Bank of Prussia.
Danatbank	13 July 1931	Banking	At the start of the Great Depression, after rumours about the solvency of the Norddeutsche Wollkämmerei & Kammgarnspinnerei, there was a bank run, and Danatbank was forced into insolvency.
Allied Crude Vegetable Oil Refining Corp	16 Nov 1963	Commodities	Commodities trader Tino De Angelis defrauded clients, including the Bank of America, into thinking he was trading vegetable oil. He got loans and made money using the oil as collateral. He

Appendix B – Major Corporate Collapses

Name	Date	Business	Causes
			showed inspectors tankers of water, with a bit of oil on the surface. When the fraud was exposed, the business collapsed.
Texaco	13 April 1987	Oil	After a legal battle with Pennzoil, whereby it was found to owe a debt of \$10.5 bn, Texaco went into bankruptcy. It was later resurrected and taken over by Chevron.
Qintex	1989	Real Estate	Qintex CEO Christopher Skase was found to have improperly used his position to obtain management fees prior to the \$1.5 billion collapse of Qintex including \$700m unpaid debts. Skase absconded to the Spanish resort island of Majorca. Spain refused extradition for 10 years during which time Skase became a citizen of Dominica.
Polly Peck	30 Oct 1990	Electronics, food, textiles	After a raid by the UK Serious Fraud Office in September 1990, the share price collapsed. The CEO Asil Nadir was convicted of stealing the company's money.
Nordbanken	1991	Banking	Following market deregulation, there was a housing price bubble, and it burst. As part of a general rescue as the Swedish banking crisis unfolded, Nordbanken was nationalised for 64 billion kronor. It was later merged with Götabanken, which itself had to write off 37.3% of its creditors, and is now known as Nordea.
Bank of Credit and Commerce International	5 July 1991	Banking	Breach of US law, by owning another bank. Fraud, money laundering and larceny.
Carrian Group	1993	Real estate	Accounting fraud. An auditor was murdered, an adviser committed suicide. The largest collapse in Hong Kong history.
Barings Bank	26 Feb 1995	Banking	An employee in Singapore, Nick Leeson, traded futures, signed off on his own accounts and became increasingly indebted. The London directors were subsequently disqualified as being unfit to run a company in Re Barings plc. (No 5).

Appendix B – Major Corporate Collapses

Name	Date	Business	Causes
Long-Term Capital Management	23 Sep 1998	Hedge fund	After purporting to have discovered a scientific method of calculating derivative prices, LTCM lost \$4.6bn in the first few months of 1998, and required state assistance to remain afloat.
Equitable Life Assurance Society	8 Dec 2000	Insurance	The insurance company's directors unlawfully used money from people holding guaranteed annuity rate policies to subsidise people with current annuity rate policies. After a House of Lords judgment in <i>Equitable Life Assurance Society v Hyman</i> , the Society closed. Though never technically insolvent, the UK government set up a compensation scheme for policyholders under the <i>Equitable Life (Payments) Act 2010</i> .
HIH Insurance	15 March 2001	Insurance	In early 2000, after increase in size of the business, it was determined that the insurance company's solvency was marginal, and a small asset price change could see the insurance company become insolvent. It did. Director Rodney Adler, CEO Ray Williams and others were sentenced to prison for fraudulent activity.
Pacific Gas and Electric Company	6 April 2001	Energy	After a change in regulation in California, the company determined it was unable to continue delivering power, and despite the California Public Utility Commission's efforts, it went into bankruptcy, leaving homes without energy. It emerged again in 2004.
One.Tel	29 May 2001	Telecomms	After becoming one of the largest Australian public companies, losses of \$290m were reported, the share price crashed, and it entered administration. In <i>ASIC v Rich</i> ^[1] the directors were found not to have been guilty of negligence.
WorldCom	21 July 2001	Telecomms	After falling share prices, and a failed share buyback scheme, it was found that the directors had used fraudulent accounting methods to push up the stock price. Rebranded MCI Inc., it emerged from bankruptcy in 2004 and the assets were bought by Verizon.
Enron	28 Nov 2001	Energy	Directors and executives fraudulently concealed large losses in Enron's projects. A number were sentenced to prison.[2][3]

Appendix B – Major Corporate Collapses

Name	Date	Business	Causes
Chiquita Brands Int	28 Nov 2001	Food	Accumulated debts, after a series of accusations relating to breaches of labour and environmental standards. It entered a pre-packaged insolvency, and emerged with similar management in 2002.[4]
Bre-X	2002	Mining	After widespread reports that Bre-X had found a gold mine in Indonesia, the stories were found to be fraudulent.
Kmart	22 Jan 2002	Retail	After difficult competition, the store was put into Chapter 11 bankruptcy proceedings, but soon re-emerged.
Adelphia Communications	13 Feb 2002	Cable television	Internal corruption. The Directors were sentenced to prison.[3][5]
Arthur Andersen	15 June 2002	Accounting	A US court convicted Andersen of obstruction of justice by shredding documents relating to Enron scandal.
Parmalat	24 Dec 2003	Food	The company's finance directors concealed large debts.
MG Rover Group	15 April 2005	Automobiles	After diminishing demand, and getting a £6.5m loan from the UK government in April 2005, the company went into administration. After the loss of 30,000 jobs, Nanjing Automobile Group bought the company's assets.
Bayou Hedge Fund Group	29 Sep 2005	Hedge fund	Samuel Israel III defrauded his investors into thinking there were higher returns, and orchestrated fake audits. The Commodity Futures Trading Commission filed a court complaint and the business was shut down after the directors were caught attempting to send \$100m into overseas bank accounts.
Refco	17 Oct 2005	Brokering	After becoming a public company in August 2005, it was revealed that Phillip R. Bennett, the company CEO and chair, had concealed \$430m of bad debts. Its underwriters were Credit Suisse First Boston, Goldman Sachs, and Bank of America Corp. The company entered Chapter 11 and Bennett was sentenced to 16 years prison.

Appendix B – Major Corporate Collapses

Name	Date	Business	Causes
Northern Rock	22 Feb 2008	Banking	Northern Rock had invested in the international markets for sub-prime mortgage debt, and as more and more people defaulted on their home loans in the US, the Rock's business collapsed. It triggered the first bank run in the UK since Overend, Gurney & Co in 1866, when it asked the UK government for assistance. It was nationalised, and then sold to Virgin Money in 2012.
Bear Stearns	14 Mar 2008	Banking	Bearn Stearns invested in the sub-prime mortgage market from 2003 after the US government had begun to deregulate consumer protection and derivative trading. The business collapsed as more people began to be unable to meet mortgage obligations. After a stock price high of \$172 a share, it was bought by JP Morgan for \$2 a share on 16 March 2008, with a \$29bn loan facility guaranteed by the US Federal Reserve.
Lehman Brothers	15 Sep 2008	Banking	Lehman Brothers' financial strategy from 2003 was to invest heavily in mortgage debt, in markets which were being deregulated from consumer protection by the US government. Losses mounted, and Lehman Brothers was forced to file for Chapter 11 bankruptcy after the US government refused to extend a loan. The collapse triggered a global financial market meltdown. Barclays, Nomura and Bain Capital purchased the assets which were not indebted.
AIG	16 Sep 2008	Insurance	Out of \$441 billion worth of securities originally rated AAA, as the US sub-prime mortgage crisis unfolded AIG found it held \$57.8 billion of these products. It was forced to take a 24 month credit facility from the US Federal Reserve Board.
Washington Mutual	26 Sep 2008	Banking	Following the sub-prime mortgage crisis, there was a bank run on WaMu, and pressure from the FDIC forced closure.
ABN-Amro	Oct 2008	Banking	After a takeover battle between Barclays and RBS, which RBS won, ABN-Amro was found to be heavily indebted due to the sub-prime mortgage crisis. It was split and taken under government ownership by the UK and Netherlands.

Appendix B – Major Corporate Collapses

Name	Date	Business	Causes
Royal Bank of Scotland Group	13 Oct 2008	Banking	Following the takeover of ABN-Amro, and the collapse of Lehman Bros, RBS found itself insolvent as the international credit market seized up. 58% of the shares were bought by the UK government.
Nortel	14 Jan 2009	Telecomms	Following the 2007-2008 financial crisis, and allegations over excessive executive pay, demand for products dropped.
Anglo Irish Bank	15 Jan 2009	Banking	After the financial crisis of 2007-2008, the bank was forced to be nationalised by the Irish government.
Arcandor	9 June 2009	Retail	After struggling to maintain business levels at its brand names Karstadt and KaDeWe, Arcandor sought help from the German government, and then filed for insolvency.
Schlecker	23 Jan 2012	Retail	After continual losses mounting from 2011 Schlecker, with 52,000 employees, was forced into insolvency, though continued to run.
Dynegy	6 July 2012	Energy	After a series of attempted takeover bids, and a finding of fraud in a subsidiary's purchase of another subsidiary, it filed for Chapter 11 bankruptcy. It emerged from bankruptcy on 2 October 2012.

Source (Wikipedia, 2014b).

12.3 Appendix C – List of Stock Market Crashes and Bear Markets

Name	Dates	Causes
Kipper und Wipper	1623	Financial crisis during the start of the Thirty Years' War (1621-1623)
Tulip mania Bubble	1637	A bubble (1633–37) in Netherlands during which contracts for bulbs of tulips reached extraordinarily high prices, and suddenly collapsed
The Mississippi Bubble	1720	Banque Royale by John Law stopped payments of its note in exchange for specie and as result caused economic collapse in France.
South Sea Bubble of 1720	1720	Affected early European stock markets, during early days of chartered joint stock companies
Bengal Bubble of 1769	1769	Primarily caused by the British East India Company, whose shares fell from £276 in December 1768 to £122 in 1784
Panic of 1796–1797	1796	
Panic of 1819	1819	
Panic of 1837	10 May 1837	
Panic of 1847	1847	
Panic of 1857	1857	
Black Friday	24 Sep 1869	
Panic of 1873	9 May 1873	Initiated the Long Depression in the United States and much of Europe

Appendix C – List of Stock Market Crashes and Bear Markets

Name	Dates	Causes
Paris Bourse crash of 1882	19 Jan 1882	
Panic of 1884	1884	
Encilhamento	1890	Lasting 3 years, 1890-1893, a Boom and bust process that boomed in late 1880s and burst in the early 1890s, causing a collapse in the Brazilian economy and aggravating an already unstable political situation.
Panic of 1893	1893	
Panic of 1896	1896	
Panic of 1901	17 May 1901	Lasting 3 years, the market was spooked by the assassination of President McKinley in 1901, coupled with a severe drought later the same year.
Panic of 1907	Oct 1907	Lasting over a year, markets took fright after U.S. President Theodore Roosevelt had threatened to rein in the monopolies that flourished in various industrial sectors, notably railways.
Wall Street Crash of 1929	24 Oct 1929	Lasting over 4 years, the bursting of the speculative bubble in shares led to further selling as people who had borrowed money to buy shares had to cash them in, when their loans were called in. Also called the Great Crash or the Wall Street Crash, leading to the Great Depression.
Recession of 1937–1938(U.S.)	1937	Lasting around a year, this share price fall was triggered by an economic recession within the Great Depression and doubts about the effectiveness of Franklin D. Roosevelt's New Deal policy.
1971 Brazilian Markets Crash	July 1971	Lasting through the 1970s and early-1980s, this was the end of a boom that started in 1969, compounded by the 1970s energy crisis coupled with early 1980s Latin American debt crisis.
1973–1974 stock	Jan 1973	Lasting 23 months, dramatic rise in oil prices, the miners' strike and the downfall of the Heath government.

Appendix C – List of Stock Market Crashes and Bear Markets

Name	Dates	Causes
market crash		
Silver Thursday	27 March 1980	Silver price crash
Souk Al-Manakh stock market crash	Aug 1982	
Black Monday	19 Oct 1987	
Rio de Janeiro Stock Exchange collapse	June 1989	Rio Stock Exchange Crash, due to its weak internal controls and absence of credit discipline, that led to its collapse, and of which it never recovered
Friday the 13th mini-crash	13 Oct 1989	Failed leveraged buyout of United Airlines causes crash
1990-1991 Recession	July 1990	Iraq invaded Kuwait in July 1990, causing oil prices to increase. The Dow dropped 18% in three months, from 2,911.63 on July 3 to 2,381.99 on October 16, 1990. This recession lasted approximately 8 months.
Japanese asset price bubble	1991	Lasting approximately twenty years, through at least to the end of 2011, share and property price bubble bursts and turns into a long deflationary recession. Some of the key economic events during the collapse of the Japanese asset price bubble include the 1997 Asian financial crisis and the Dot.com bubble. In addition, more recent economic events, such as the late-2000s financial crisis and August 2011 stock markets fall have prolonged this period.
Black Wednesday	16 Sep 1992	The Conservative government was forced to withdraw the pound sterling from the European Exchange Rate Mechanism (ERM) after they were unable to keep sterling above its agreed lower limit.
1997 Asian financial crisis	2 July 1997	Investors deserted emerging Asian shares, including an overheated Hong Kong stock market. Crashes occur in Thailand, Indonesia, South Korea, Philippines, and elsewhere, reaching a climax in the October 27, 1997 mini-crash.

Appendix C – List of Stock Market Crashes and Bear Markets

Name	Dates	Causes
October 27, 1997 mini-crash	27 Oct 1997	Global stock market crash that was caused by an economic crisis in Asia. The points loss that the Dow Jones Industrial Average suffered on this day still ranks as the eighth biggest point loss in its 117-year existence.
1998 Russian financial crisis	17 Aug 1998	The Russian government devalues the rouble, defaults on domestic debt, and declares a moratorium on payment to foreign creditors.
Dot-com bubble	10 March 2000	Collapse of a technology bubble, world economic effects arising from the September 11 attacks and the stock market downturn of 2002.
Economic effects arising from the September 11 attacks	11 Sep 2001	The September 11 attacks caused global stock markets to drop sharply. The attacks themselves caused approximately \$40 billion in insurance losses, making it one of the largest insured events ever.
Stock market downturn of 2002	9 Oct 2002	Downturn in stock prices during 2002 in stock exchanges across the United States, Canada, Asia, and Europe. After recovering from lows reached following the September 11 attacks, indices slid steadily starting in March 2002, with dramatic declines in July and September leading to lows last reached in 1997 and 1998.
Chinese stock bubble of 2007	27 Feb 2007	The SSE Composite Index of the Shanghai Stock Exchange tumbles 9% from unexpected selloffs, the largest drop in 10 years, triggering major drops in worldwide stock markets.
United States bear market of 2007–2009	11 Oct 2007	Up until June 2009, the Dow Jones Industrial Average, Nasdaq Composite and S&P 500 all experienced declines of greater than 20% from their peaks in late 2007.
Late-2000s financial crisis	16 Sep 2008	On September 16, 2008, failures of large financial institutions in the United States, due primarily to exposure of securities of packaged subprime loans and credit default swaps issued to insure these loans and their issuers, rapidly devolved into a global crisis resulting in a number of bank failures in Europe and sharp reductions in the value of equities (stock) and commodities worldwide. The failure of banks in Iceland resulted in a devaluation of the Icelandic króna and threatened the government with bankruptcy. Iceland was able to secure an emergency loan from the IMF in November. Later on, U.S. President George W. Bush signs the Emergency Economic Stabilization Act into law, creating a Troubled Asset Relief Program (TARP) to purchase failing

Appendix C – List of Stock Market Crashes and Bear Markets

Name	Dates	Causes
		bank assets.
2009 Dubai debt standstill	November 27, 2009	Dubai requests a debt deferment following its massive renovation and development projects, as well as the late-2000s recession. The announcement causes global stock markets to drop.
European sovereign debt crisis	27 April 2010	Standard & Poor's downgrades Greece's sovereign credit rating to junk four days after the activation of a €45-billion EU-IMF bailout, triggering the decline of stock markets worldwide and of the Euro's value, and furthering a European sovereign debt crisis.
2010 Flash Crash	6 May 2010	The Dow Jones Industrial Average suffers its worst intra-day point loss, dropping nearly 1,000 points before partially recovering.
August 2011 stock markets fall	Aug 2011	Stock markets around the world plummet during late July and early August, and are volatile for the rest of the year.

(Wikipedia, 2014c)

12.4 Appendix D – CFfFR Working Document

THE CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING

The Conceptual Framework was issued by the IASB in September 2010. It superseded the Framework for the Preparation and Presentation of Financial Statements.

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THE CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING

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| 2 The reporting entity <i>to be added</i> | |
| 3 Qualitative characteristics of useful financial information | QC1 |
| 4 The <i>Framework</i> (1989): the remaining text | |

Foreword

The International Accounting Standards Board is currently in the process of updating its conceptual framework. This conceptual framework project is conducted in phases.

As a chapter is finalised, the relevant paragraphs in the *Framework for the Preparation and Presentation of Financial Statements* that was published in 1989 will be replaced. When the conceptual framework project is completed, the Board will have a complete, comprehensive and single document called the *Conceptual Framework for Financial Reporting*.

This version of the *Conceptual Framework* includes the first two chapters the Board published as a result of its first phase of the conceptual framework project—Chapter 1 *The objective of general purpose financial reporting* and Chapter 3 *Qualitative characteristics of useful financial information*. Chapter 2 will deal with the reporting entity concept. The Board published an exposure draft on this topic in March 2010 with a comment period that ended on 16 July 2010. Chapter 4 contains the remaining text of the *Framework* (1989). The table of concordance, at the end of this publication, shows how the contents of the *Framework* (1989) and the *Conceptual Framework* (2010) correspond.

The Introduction has been carried forward from the *Framework* (1989). This will be updated when the IASB considers the purpose of the *Conceptual Framework*. Until then, the purpose and the status of the *Conceptual Framework* are the same as before.

Introduction

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
	<p>KEY TO ANALYSIS and ABBREVIATIONS USED:</p> <p>CQ = Competency Question: forms part of the requirements to be addressed by the ontology.</p> <p>Ontology: Classes and relations identified for the ontology.</p> <p>Issues: Problems identified in the text that can either not be modeled, is ambiguous or require further research beyond the scope of this study.</p> <p>CFfFR: Conceptual Framework for Financial Reporting</p> <p>CFfFRO: Conceptual Framework for Financial Reporting Ontology</p> <p>FR: Financial Report.</p>
<p>Financial statements are prepared and presented for external users by many entities around the world. Although such financial statements may appear similar from country to country, there are differences, which have probably been caused by a variety of social, economic and legal circumstances and by different countries having in mind the needs of different users of financial statements when setting national requirements.</p>	<p>CQ: Users (external to the reporting entity) require financial information that is useful for decision-making under a variety of social, economic and legal circumstances. How can the ontology assist to provide decision-useful information to users of financial reports?</p> <p>Ontology: Financial Report, Financial</p>

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	Statement, Issues: Financial statements vs financial reports. The two terms are used interchangeable, but they are not the same. Terminology is not used consistently in the CFfFR: Entity vs. reporting entity; information vs financial information vs decision-useful information. External users implies other users such as “internal users”. Are they to be treated the same? Who are internal users?
<p>These different circumstances have led to the use of a variety of definitions of the elements of financial statements: for example, assets, liabilities, equity, income and expenses. They have also resulted in the use of different criteria for the recognition of items in the financial statements and in a preference for different bases of measurement. The scope of the financial statements and the disclosures made in them have also been affected.</p> <p>The International Accounting Standards Board is committed to narrowing these differences by seeking to harmonise regulations, accounting standards and procedures relating to the preparation and presentation of financial statements. It believes that further harmonisation can best be pursued by focusing on financial statements that are prepared for the purpose of providing information that is useful in making economic decisions.</p>	CQ: How can the basic concepts be modeled or formalised so that they are consistent and unambiguous? Ontology: Element, asset, liability, equity, income, expense, measurement and recognition criteria. Classes identified in the definitions of the elements. Issues: Recognition criteria forms part of the formalisation of the elements. Recognition criteria is not identified as a separate class to be formalised. Different definitions but the ontology should standardize on one definition for a concept to be unambiguous and consistent. What is meant by economic decisions? It should be clearly defined, as it must determine the scope of the information that should be provided in a financial report.
<p>The Board believes that financial statements prepared for this purpose meet the common needs of most users. This is because nearly all users are making economic decisions, for example: to decide when to buy, hold or sell an equity investment.</p> <p>to assess the stewardship or accountability of management.</p>	CQ: Common needs of most users to make economic decisions. This CQ needs to be broken down: <ul style="list-style-type: none"> • Who are ‘most users’?

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>to assess the ability of the entity to pay and provide other benefits to its employees.</p> <p>to assess the security for amounts lent to the entity.</p> <p>to determine taxation policies.</p> <p>to determine distributable profits and dividends.</p> <p>to prepare and use national income statistics.</p> <p>to regulate the activities of entities.</p>	<ul style="list-style-type: none"> What information is needed for these economic decisions (as listed)? The ontology should then ensure that the information captured about basic concepts answers these questions <p>Ontology:</p> <p>Issues:</p>
<p>The Board recognises, however, that governments, in particular, may specify different or additional requirements for their own purposes. These requirements should not, however, affect financial statements published for the benefit of other users unless they also meet the needs of those other users.</p>	<p>CQ: Scope is fixed and not altered when external requirements are imposed.</p> <p>Ontology:</p> <p>Issues: Board in this case is the IASB. Conflict of information needed by users is identified by the IASB Board.</p>
<p>Financial statements are most commonly prepared in accordance with an accounting model based on recoverable historical cost and the nominal financial capital maintenance concept. Other models and concepts may be more appropriate in order to meet the objective of providing information that is useful for making economic decisions although there is at present no consensus for change. This <i>Conceptual Framework</i> has been developed so that it is applicable to a range of accounting models and concepts of capital and capital maintenance.</p>	<p>CQ: Does the ontology adequately capture the classes and relations required for such economic models used for financial reports?</p> <p>Ontology:</p> <p>Issues:</p>

Purpose and status

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>This Conceptual Framework sets out the concepts that underlie the preparation and presentation of financial statements for external users. The purpose of the Conceptual Framework is:</p> <ul style="list-style-type: none"> • to assist the Board in the development of future IFRSs and in its review of existing IFRSs; • to assist the Board in promoting harmonisation of regulations, accounting standards and procedures relating to the presentation of financial statements by providing a basis for reducing the number of alternative accounting treatments permitted by IFRSs; • to assist national standard-setting bodies in developing national standards; • to assist preparers of financial statements in applying IFRSs and in dealing with topics that have yet to form the subject of an IFRS; • to assist auditors in forming an opinion on whether financial statements comply with IFRSs; • to assist users of financial statements in interpreting the information contained in financial statements prepared in compliance with IFRSs; and • to provide those who are interested in the work of the IASB with information about its approach to the formulation of IFRSs. 	<p>CQ:</p> <ul style="list-style-type: none"> • What are the classes that underlie the preparation and presentation of financial reports for external users? (this is the core competency question for the CFfFRO). • Each of the bullets should be translated into a requirement / CQ. • Does the CFfFRO assist the Board in the development of future IFRSs and in its review of existing IFRSs; (the criteria to measure this should be established e.g. standardized definitions could assist with this and if the ontology provide those, it fulfils this purpose)? • Does the CFfFRO assist the Board in promoting harmonisation of regulations, accounting standards and procedures relating to the presentation of financial statements by providing a basis for reducing the number of alternative accounting treatments permitted by IFRSs? • Does the CFfFRO assist national standard-setting bodies in developing national standards? • Does the CFfFRO assist preparers of financial statements in applying IFRSs and in dealing with topics that have yet to form the subject of an IFRS? • Does the CFfFRO assist auditors in forming an opinion on whether financial

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	<p>statements comply with IFRSs?</p> <ul style="list-style-type: none"> • Does the CFfFRO assist users of financial statements in interpreting the information contained in financial statements prepared in compliance with IFRSs? • Does the CFfFRO provide those who are interested in the work of the IASB with information about its approach to the formulation of IFRSs? <p>Ontology: Issues: Criteria for measurements to fulfill the objectives and CQs to be established. What does it mean to ‘assist national standard-setting bodies in developing national standards’?</p>
<p>This Conceptual Framework is not an IFRS and hence does not define standards for any particular measurement or disclosure issue. Nothing in this Conceptual Framework overrides any specific IFRS.</p> <p>The Board recognises that in a limited number of cases there may be a conflict between the Conceptual Framework and an IFRS. In those cases where there is a conflict, the requirements of the IFRS prevail over those of the Conceptual Framework. As, however, the Board will be guided by the Conceptual Framework in the development of future IFRSs and in its review of existing IFRSs, the number of cases of conflict between the Conceptual Framework and IFRSs will diminish through time</p>	<p>CQ: The CFfFRO does not define standards for any particular measurement or disclosure issue. Nothing in this CFfFRO overrides any specific IFRS.</p> <p>Ontology: Issues: The CFfFR should contain the basic principles and concepts and inform decision making, and IFRSs should actually not override the CFfFR. See the discussion on the CFfFR as a meta-metamodel.</p>
<p>The Conceptual Framework will be revised from time to time on the basis of the Board's experience of working with it.</p>	<p>CQ: The CFfFRO should provide mechanisms for revision and versioning.</p> <p>Issues: Versioning in ontologies that maintain consistency is a challenge.</p>

Scope

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>The Conceptual Framework deals with:</p> <ul style="list-style-type: none"> • the objective of financial reporting; • the qualitative characteristics of useful financial information; • the definition, recognition and measurement of the elements from which financial statements are constructed; and • concepts of capital and capital maintenance. 	<p>CQ: Ensure that the objective of financial reporting is met Qualitative characteristics of useful information is integrated into the CFfFR construction (so that it actually provides useful financial information and construct reports that does this).</p> <p>Ontology: The definition, recognition and measurement of the elements from which financial statements are constructed; and concepts of capital and capital maintenance.</p> <p>Issues:</p> <ul style="list-style-type: none"> • What is useful financial information? • How can it be measured to ensure that the ontology and subsequent financial report fulfills this objective?

CONTENTS*from paragraph***CHAPTER 1: THE OBJECTIVE OF GENERAL PURPOSE
FINANCIAL REPORTING**

Introduction	OB1
Objective, usefulness and limitations of general purpose Financial reporting	OB2
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Economic resources and claims	OB13
Changes in economic resources and claims	OB15
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Chapter 1: The objective of general purpose financial reporting Introduction

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>OB1 The objective of general purpose financial reporting forms the foundation of the <i>Conceptual Framework</i>. Other aspects of the <i>Conceptual Framework</i>—a reporting entity concept, the qualitative characteristics of, and the constraint on, useful financial information, elements of financial statements, recognition, measurement, presentation and disclosure—flow logically from the objective.</p>	<p>CQ:</p> <ul style="list-style-type: none"> • Scope is FR (financial reporting) and what should be contained therein and how it should be represented? • Financial information reported in a Financial Report must adhere to the qualitative characteristics and disclosure requirements. <p>Ontology: Element, financial statement, financial report, reporting entity, measurement.</p> <p>Issues:</p> <ul style="list-style-type: none"> • Financial information is defined as what is provided by FR as well as its parts and elements. It is therefore not a concept in the CFfFRO. • A definition and description of a reporting entity is still outstanding. • Qualitative characteristics are requirements that financial information must adhere to in order to be included in a financial report. • The section on disclosure requirements is still outstanding. • The section on measurement is under revision as the current section is considered to be insufficient (Barth, 2013).

Objective, usefulness and limitations of general purpose financial reporting

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>OB2 The objective of general purpose financial reporting is to provide financial information about the reporting entity that is useful to existing and potential investors, lenders and other creditors in making decisions about providing resources to the entity. Those decisions involve buying, selling or holding equity and debt instruments, and providing or settling loans and other forms of credit.</p>	<p>CQ: CFfFRO should assist with providing decision-useful information to identified users.</p> <p>Ontology: Equity</p> <p>Issues: Decisions of users are based on financial information. Whether this information is useful is vague, factors that influence this could be based on the profile of the user, his / her context and how he/she makes decisions. What is meant with decision usefulness needs to be explored.</p>
<p>OB3 Decisions by existing and potential investors about buying, selling or holding equity and debt instruments depend on the returns that they expect from an investment in those instruments, for example dividends, principal and interest payments or market price increases. Similarly, decisions by existing and potential lenders and other creditors about providing or settling loans and other forms of credit depend on the principal and interest payments or other returns that they expect. Investors', lenders' and other creditors' expectations about returns depend on their assessment of the amount, timing and uncertainty of (the prospects for) future net cash inflows to the entity. Consequently, existing and potential investors, lenders and other creditors need information to help them assess the prospects for future net cash inflows to an entity.</p>	<p>CQ:</p> <p>Ontology: Users (are these external users?) = Investors', lenders' and other creditors</p> <p>Issues:</p> <ul style="list-style-type: none"> • See issue of OB2 above – same holds here. • Decisions flow from the use of the CFfFRO and thus inform the criteria the CFfFRO should fulfill. Decisions are not part of the model. • Users use FR – for now they are included in the CFfFRO model, but since use is excluded, the case may be made that users are also excluded and just give the CQ or criteria for the ontology.
<p>OB4 To assess an entity's prospects for future net cash inflows, existing and potential investors, lenders and other creditors need information about the resources of the entity, claims against the</p>	<p>CQ:</p> <p>Ontology: Users of the CFfFR - existing</p>

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<p>entity, and how efficiently and effectively the entity's management and governing board² have discharged their responsibilities to use the entity's resources. Examples of such responsibilities include protecting the entity's resources from unfavourable effects of economic factors such as price and technological changes and ensuring that the entity complies with applicable laws, regulations and contractual provisions. Information about management's discharge of its responsibilities is also useful for decisions by existing investors, lenders and other creditors who have the right to vote on or otherwise influence management's actions.</p>	<p>and potential investors, lenders and other creditors.</p> <p>Issues: See issues above Users use FR – for now they are included in the CFfFRO model, but since use is excluded, the case may be made that users are also excluded and just give the CQ or criteria for the ontology.</p>
<p>OB5 Many existing and potential investors, lenders and other creditors cannot require reporting entities to provide information directly to them and must rely on general purpose financial reports for much of the financial information they need. Consequently, they are the primary users to whom general purpose financial reports are directed.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: See issues above</p>
<p>OB6 However, general purpose financial reports do not and cannot provide all of the information that existing and potential investors, lenders and other creditors need. Those users need to consider pertinent information from other sources, for example, general economic conditions and expectations, political events and political climate, and industry and company outlooks.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: Beyond the scope of the CF and CFfFRO – how users use information and make decisions cannot be constrained by either the CFfFR or the CFfFRO. Therefore – decision-usefulness given the CFfFR should be defined with measurable criteria.</p>
<p>OB7 General purpose financial reports are not designed to show the value of a reporting entity; but they provide information to help existing and potential investors, lenders and other creditors to estimate the value of the reporting entity.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>OB8 Individual primary users have different, and possibly conflicting, information needs and desires. The Board, in developing financial reporting standards, will seek to provide the information set that will meet the needs of the maximum number of primary users. However, focusing on common information needs does not prevent the reporting entity from including additional information that is most useful to a particular subset of primary users.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: Board here is IASB. Also beyond the scope – what information is provided above and in conjunction with FR guided by the CFfFR and CFfFRO cannot be constrained, neither how</p>

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
	decisions are made. It must just be clear exactly what is provided by FR and how this information could be used to make decisions (e.g. decision usefulness definition and criteria)
OB9 The management of a reporting entity is also interested in financial information about the entity. However, management need not rely on general purpose financial reports because it is able to obtain the financial information it needs internally.	CQ: Ontology: Reporting Entity Management Issues: See above. Is management also a user but not an external user? The information needed by management falls outside the scope of the CFfFR.
OB10 Other parties, such as regulators and members of the public other than investors, lenders and other creditors, may also find general purpose financial reports useful. However, those reports are not primarily directed to these other groups.	CQ: Ontology: Issues: See above. Are these other 'external users'?
OB11 To a large extent, financial reports are based on estimates, judgements and models rather than exact depictions. The Conceptual Framework establishes the concepts that underlie those estimates, judgements and models. The concepts are the goal towards which the Board and preparers of financial reports strive. As with most goals, the Conceptual Framework's vision of ideal financial reporting is unlikely to be achieved in full, at least not in the short term, because it takes time to understand, accept and implement new ways of analysing transactions and other events. Nevertheless, establishing a goal towards which to strive is essential if financial reporting is to evolve so as to improve its usefulness.	CQ: <ul style="list-style-type: none"> • High level goal of CFfFR is to provide concepts to support judgements. • High level goal of the CFfFRO is to provide classes that would support judgements. Ontology: Issues: <ul style="list-style-type: none"> • Hopefully the CFfFRO could assist with reaching this goal. • What Board are referred to, IASB Board, or Board of the reporting entity?
Footnote 1. Throughout this <i>Conceptual Framework</i> , the terms <i>financial reports</i> and <i>financial reporting</i> refer to <i>general purpose financial reports</i> and <i>general purpose financial reporting</i> unless specifically indicated otherwise.	CQ: Definitions of FR Ontology: Issues:

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
Footnote 2. Throughout this <i>Conceptual Framework</i> , the term <i>management</i> refers to <i>management and the governing board of an entity</i> unless specifically indicated otherwise.	CQ: Ontology: Issues:

Information about a reporting entity's economic resources, claims against the entity and changes in resources and claims

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
OB12 General purpose financial reports provide information about the financial position of a reporting entity, which is information about the entity's economic resources and the claims against the reporting entity. Financial reports also provide information about the effects of transactions and other events that change a reporting entity's economic resources and claims. Both types of information provide useful input for decisions about providing resources to an entity.	CQ: Ontology: FR provide information about FinancialPosition EconomicResource Claim Issues: <ul style="list-style-type: none"> • Is a EconomicResource the same as a Controlled Resource as per asset definition? • Decisions are not part of the CFfFR or the CFfFRO, it is the result of using the CFfFR and the CFfFRO.

Economic resources and claims

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
OB13 Information about the nature and amounts of a reporting entity's economic resources and claims can help users to identify the reporting entity's financial strengths and weaknesses. That information can help users to assess the reporting entity's liquidity and solvency, its needs for additional financing and how	CQ: Ontology: EconomicResource Claim

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>successful it is likely to be in obtaining that financing. Information about priorities and payment requirements of existing claims helps users to predict how future cash flows will be distributed among those with a claim against the reporting entity.</p>	<p>Issues:</p> <ul style="list-style-type: none"> • Is a EconomicResource the same as a Controlled Resource as per asset definition? • Where is the 'priorities and payment requirements of existing claims' information provided? • Is it part of statements? • Derived information from statements or additional information on statements?
<p>OB14 Different types of economic resources affect a user's assessment of the reporting entity's prospects for future cash flows differently. Some future cash flows result directly from existing economic resources, such as accounts receivable. Other cash flows result from using several resources in combination to produce and market goods or services to customers. Although those cash flows cannot be identified with individual economic resources (or claims), users of financial reports need to know the nature and amount of the resources available for use in a reporting entity's operations.</p>	<p>CQ: FR must contain information on the different types of Resources and claims, nature and amount of resources and claims available for the entity's operations.</p> <p>Ontology: EconomicResource Claim</p> <p>Issues:</p> <ul style="list-style-type: none"> • What are 'different types of Economic Resources'? • Nature of resources the same as type of resources? • In the current ontology only Asset is a Controlled Resource

Changes in economic resources and claims

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>OB15 Changes in a reporting entity's economic resources and claims result from that entity's financial performance (see paragraphs OB17–OB20) and from other events or transactions such as issuing debt or equity instruments (see paragraph OB21). To properly assess the prospects for future cash flows from the reporting entity, users need to be able to distinguish between both of these changes.</p>	<p>CQ: Users need to assess economic resources and claims result from that entity's financial performance from use of FR</p> <p>Ontology: EconomicResource Claim FinancialPerformance</p> <p>Issues: Economic resource is not clearly defined in the CFfFR.</p>
<p>OB16 Information about a reporting entity's financial performance helps users to understand the return that the entity has produced on its economic resources. Information about the return the entity has produced provides an indication of how well management has discharged its responsibilities to make efficient and effective use of the reporting entity's resources. Information about the variability and components of that return is also important, especially in assessing the uncertainty of future cash flows. Information about a reporting entity's past financial performance and how its management discharged its responsibilities is usually helpful in predicting the entity's future returns on its economic resources.</p>	<p>CQ:</p> <p>Ontology: Resource, Management, Past, Future FinancialPerformance.</p> <p>Issues:</p> <ul style="list-style-type: none"> • Is entity and reporting entity the same? Terminology must be standardized. • See previous comments on reporting entity, not yet defined. • See previous comments on information. • Prediction of future returns falls outside the scope of the CFfFR or the CFfFRO. See comments on users decisions.

Financial performance reflected by accrual accounting

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>OB17 Accrual accounting depicts the effects of transactions and other events and circumstances on a reporting entity's economic resources and claims in the periods in which those effects occur, even if the resulting cash receipts and payments occur in a different period. This is important because information about a reporting entity's economic resources and claims and changes in its economic resources and claims during a period provides a better basis for assessing the entity's past and future performance than information solely about cash receipts and payments during that period.</p>	<p>CQ: The CFfFRO must support the idea of accrual accounting.</p> <p>Ontology: The modeling of time and principles related to time supports accrual accounting. Resource, claim, past future,</p> <p>Issues: Does performance refers to financial performance (Income and expense)?</p>
<p>OB18 Information about a reporting entity's financial performance during a period, reflected by changes in its economic resources and claims other than by obtaining additional resources directly from investors and creditors (see paragraph OB21), is useful in assessing the entity's past and future ability to generate net cash inflows. That information indicates the extent to which the reporting entity has increased its available economic resources, and thus its capacity for generating net cash inflows through its operations rather than by obtaining additional resources directly from investors and creditors.</p>	<p>CQ:</p> <p>Ontology: FinancialPerformance, EconomicResource, CashFlow</p> <p>Issues: See issues regarding information / financial information earlier</p>
<p>OB19 Information about a reporting entity's financial performance during a period may also indicate the extent to which events such as changes in market prices or interest rates have increased or decreased the entity's economic resources and claims, thereby affecting the entity's ability to generate net cash inflows.</p>	<p>CQ: The CFfFRO should result in information regarding changes in market prices.</p> <p>Ontology: EconomicResource, claim, CashFlow, time, past, future.</p> <p>Issues:</p> <ul style="list-style-type: none"> • Information regarding changes in market prices can only be provided if the measurement of the elements of a FR is aligned with market prices. • Measurement is not defined accordingly in the CFfFR. (Barth, 2013).

Financial performance reflected by past cash flows

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<p>OB20 Information about a reporting entity's cash flows during a period also helps users to assess the entity's ability to generate future net cash inflows. It indicates how the reporting entity obtains and spends cash, including information about its borrowing and repayment of debt, cash dividends or other cash distributions to investors, and other factors that may affect the entity's liquidity or solvency. Information about cash flows helps users understand a reporting entity's operations, evaluate its financing and investing activities, assess its liquidity or solvency and interpret other information about financial performance.</p>	<p>CQ: See comments in OB19. See comments on how information is provide via the CFFRO.</p> <p>Ontology: CashFlow, ReportingEntity, Time, Future, FinancialPerformance.</p> <p>Issues: Understanding by users of a reporting entity's operations is related to the individual users' goals and purpose. It cannot be modelled and falls outside the scope of the CFFRO.</p>

Changes in economic resources and claims not resulting from financial performance

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<p>OB21 A reporting entity's economic resources and claims may also change for reasons other than financial performance, such as issuing additional ownership shares. Information about this type of change is necessary to give users a complete understanding of why the reporting entity's economic resources and claims changed and the implications of those changes for its future financial performance.</p>	<p>CQ:</p> <p>Ontology: EconomicResource, Claim, FinancialPerformance, Shareholder</p> <p>Issues:</p>

CHAPTER 2: THE REPORTING ENTITY

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<i>[to be added]</i>	CQ: Ontology: Issues: The CFfFR is incomplete as a critical class definition for Reporting Entity is not provided.

CHAPTER 3: QUALITATIVE CHARACTERISTICS OF USEFUL FINANCIAL INFORMATION

INTRODUCTION	QC1
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Relevance	QC6
Faithful representation	QC12
Applying the fundamental qualitative characteristics	QC17
Enhancing qualitative characteristics	QC19
Comparability	QC20
Verifiability	QC26
Timeliness	QC29
Understandability	QC30
Applying the enhancing characteristics	QC33
THE COST CONSTRAINT ON USEFUL FINANCIAL REPORTING	QC35

Introduction

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>QC1 The qualitative characteristics of useful financial information discussed in this chapter identify the types of information that are likely to be most useful to the existing and potential investors, lenders and other creditors for making decisions about the reporting entity on the basis of information in its financial report (financial information).</p>	<p>CQ: The information provided by the CFFRO should adhere to the qualitative characteristics of useful financial information. Ontology:</p> <p>Issues: The “class” qualitative characteristics cannot be modeled as it is a competency question. If the ontology is well structured and the definitions clear and unambiguous the information as a result of the CFFRO should adhere to the qualitative characteristics.</p>
<p>QC2 Financial reports provide information about the reporting entity’s economic resources, claims against the reporting entity and the effects of transactions and other events and conditions that change those resources and claims. (This information is referred to in the Conceptual Framework as information about the economic phenomena.) Some financial reports also include explanatory material about management’s expectations and strategies for the reporting entity, and other types of forward-looking information.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC3 The qualitative characteristics of useful financial information³ apply to financial information provided in financial statements, as well as to financial information provided in other ways. Cost, which is a pervasive constraint on the reporting entity’s ability to provide useful financial information, applies similarly. However, the considerations in applying the qualitative characteristics and the cost constraint may be different for different types of information. For example, applying them to forward-looking information may be different from applying them to information about existing economic resources and claims and to changes in those resources and claims.</p>	<p>CQ: Ontology: Issues:</p>

Qualitative characteristics of useful financial information

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<p>QC4 If financial information is to be useful, it must be relevant and faithfully represent what it purports to represent. The usefulness of financial information is enhanced if it is comparable, verifiable, timely and understandable.</p>	<p>CQ: Ontology: Issues:</p>

Fundamental qualitative characteristics

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<p>QC5 The fundamental qualitative characteristics are relevance and faithful representation.</p>	<p>CQ: The CFfFRO concepts, relations and model should provide information that is relevant and a faithful representation.</p> <p>Ontology:</p> <p>Issues: The criteria for information to be relevant and a faithful and how to measure it (some of this is provided below)</p>

Relevance

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<p>QC6 Relevant financial information is capable of making a difference in the decisions made by users. Information may be capable of making a difference in a decision even if some users choose not to take advantage of it or are already aware of it from other sources.</p>	<p>CQ: Relevance forms part of the competency questions.</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC7 Financial information is capable of making a difference in decisions if it has predictive value, confirmatory value or both.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC8 Financial information has predictive value if it can be used as an input to processes employed by users to predict future outcomes. Financial information need not be a prediction or forecast to have predictive value. Financial information with predictive value is employed by users in making their own predictions.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC9 Financial information has confirmatory value if it provides feedback about (confirms or changes) previous evaluations.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC10 The predictive value and confirmatory value of financial information are interrelated. Information that has predictive value often also has confirmatory value. For example, revenue information for the current year, which can be used as the basis for predicting revenues in future years, can also be compared with revenue predictions for the current year that were made in past years. The results of those comparisons can help a user to correct and improve the processes that were used to make those previous predictions.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>

Materiality

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<p>QC11 Information is material if omitting it or misstating it could influence decisions that users make on the basis of financial information about a specific reporting entity. In other words, materiality is an entity-specific aspect of relevance based on the nature or magnitude, or both, of the items to which the information relates in the context of an individual entity's financial report. Consequently, the Board cannot specify a uniform quantitative threshold for materiality or predetermine what could be material in a particular situation.</p>	<p>CQ: Materiality forms part of the competency questions. Ontology: Issues:</p>

Faithful representation

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<p>QC12 Financial reports represent economic phenomena in words and numbers. To be useful, financial information must not only represent relevant phenomena, but it must also faithfully represent the phenomena that it purports to represent. To be a perfectly faithful representation, a depiction would have three characteristics. It would be complete, neutral and free from error. Of course, perfection is seldom, if ever, achievable. The Board's objective is to maximise those qualities to the extent possible.</p>	<p>CQ: Faithful representation forms part of the competency questions. Ontology: Issues:</p>
<p>QC13 A complete depiction includes all information necessary for a user to understand the phenomenon being depicted, including all necessary descriptions and explanations. For example, a complete depiction of a group of assets would include, at a minimum, a description of the nature of the assets in the group, a numerical depiction of all of the assets in the group, and a description of what the numerical depiction represents (for example, original cost, adjusted cost or fair value). For some items, a complete depiction may also entail explanations of significant facts about the quality and nature of the items, factors and circumstances that might affect their quality and nature, and the process used to determine the numerical depiction.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC14 A neutral depiction is without bias in the selection or presentation of financial information. A neutral depiction is not slanted, weighted, emphasised, de-emphasised or otherwise manipulated to increase the probability that financial information will be received favourably or unfavourably by users. Neutral information does not mean information with no purpose or no influence on behaviour. On the contrary, relevant financial information is, by definition, capable of making a difference in users' decisions.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC15 Faithful representation does not mean accurate in all respects. Free from error means there are no errors or omissions in the description of the phenomenon, and the process used to produce the reported information has been</p>	<p>CQ: Ontology: Issues:</p>

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<p>selected and applied with no errors in the process. In this context, free from error does not mean perfectly accurate in all respects. For example, an estimate of an unobservable price or value cannot be determined to be accurate or inaccurate. However, a representation of that estimate can be faithful if the amount is described clearly and accurately as being an estimate, the nature and limitations of the estimating process are explained, and no errors have been made in selecting and applying an appropriate process for developing the estimate.</p>	
<p>QC16 A faithful representation, by itself, does not necessarily result in useful information. For example, a reporting entity may receive property, plant and equipment through a government grant. Obviously, reporting that an entity acquired an asset at no cost would faithfully represent its cost, but that information would probably not be very useful. A slightly more subtle example is an estimate of the amount by which an asset's carrying amount should be adjusted to reflect an impairment in the asset's value. That estimate can be a faithful representation if the reporting entity has properly applied an appropriate process, properly described the estimate and explained any uncertainties that significantly affect the estimate. However, if the level of uncertainty in such an estimate is sufficiently large, that estimate will not be particularly useful. In other words, the relevance of the asset being faithfully represented is questionable. If there is no alternative representation that is more faithful, that estimate may provide the best available information.</p>	<p>CQ: Ontology: Issues:</p>

Applying the fundamental qualitative characteristics

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<p>QC17 Information must be both relevant and faithfully represented if it is to be useful. Neither a faithful representation of an irrelevant phenomenon nor an unfaithful representation of a relevant phenomenon helps users make good decisions.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC18 The most efficient and effective process for applying the fundamental qualitative characteristics would usually be as follows (subject to the effects of enhancing characteristics and the cost constraint, which are not considered in this example). First, identify an economic phenomenon that has the potential to be useful to users of the reporting entity's financial information. Second, identify the type of information about that phenomenon that would be most relevant if it is available and can be faithfully represented. Third, determine whether that information is available and can be faithfully represented. If so, the process of satisfying the fundamental qualitative characteristics ends at that point. If not, the process is repeated with the next most relevant type of information.</p>	<p>CQ: The CFfFRO should be able to assist with the execution of the steps in this proposed process with clear definitions, classification and adherence criteria given the definition of concepts through characteristics and the relations between concepts.</p> <p>Ontology:</p> <p>Issues: What constitutes 'types of information'? For the purpose of the CFfFR this should be all the elements and parts in a FR.</p>

Enhancing qualitative characteristics

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<p>QC19 Comparability, verifiability, timeliness and understandability are qualitative characteristics that enhance the usefulness of information that is relevant and faithfully represented. The enhancing qualitative characteristics may also help determine which of two ways should be used to depict a phenomenon if both are considered equally relevant and faithfully represented.</p>	<p>CQ: Comparability, verifiability, timeliness and understandability are characteristics that the information provided in and from the CFFRO should have.</p> <p>Ontology:</p> <p>Issues: How to measure comparability, verifiability, timeliness and understandability to ensure that these requirements are met.</p>

Comparability

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<p>QC20 Users' decisions involve choosing between alternatives, for example, selling or holding an investment, or investing in one reporting entity or another. Consequently, information about a reporting entity is more useful if it can be compared with similar information about other entities and with similar information about the same entity for another period or another date.</p>	<p>CQ: Comparability forms part of the competency questions.</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC21 Comparability is the qualitative characteristic that enables users to identify and understand similarities in, and differences among, items. Unlike the other qualitative characteristics, comparability does not relate to a single item. A comparison requires at least two items.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC22 Consistency, although related to comparability, is not the same. Consistency refers to the use of the same methods for the same items, either from period to period within a reporting entity or in a single period across entities. Comparability is the goal; consistency helps to achieve that goal.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC23 Comparability is not uniformity. For information to be comparable, like things must look alike and different things must look different. Comparability of financial information is not enhanced by making unlike things look alike any more than it is enhanced by making like things look different.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>QC24 Some degree of comparability is likely to be attained by satisfying the fundamental qualitative characteristics. A faithful representation of a relevant economic phenomenon should naturally possess some degree of comparability with a faithful representation of a similar relevant economic phenomenon by another reporting entity.</p> <p>QC25 Although a single economic phenomenon can be faithfully</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>

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represented in multiple ways, permitting alternative accounting methods for the same economic phenomenon diminishes comparability.	

Verifiability

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QC26 Verifiability helps assure users that information faithfully represents the economic phenomena it purports to represent. Verifiability means that different knowledgeable and independent observers could reach consensus, although not necessarily complete agreement, that a particular depiction is a faithful representation. Quantified information need not be a single point estimate to be verifiable. A range of possible amounts and the related probabilities can also be verified.	CQ: Verifiability forms part of the competency questions. Ontology: Issues:
QC27 Verification can be direct or indirect. Direct verification means verifying an amount or other representation through direct observation, for example, by counting cash. Indirect verification means checking the inputs to a model, formula or other technique and recalculating the outputs using the same methodology. An example is verifying the carrying amount of inventory by checking the inputs (quantities and costs) and recalculating the ending inventory using the same cost flow assumption (for example, using the first-in, first-out method).	CQ: Ontology: Issues:
QC28 It may not be possible to verify some explanations and forward-looking financial information until a future period, if at all. To help users decide whether they want to use that information, it would normally be necessary to disclose the underlying assumptions, the methods of compiling the information and other factors and circumstances that support the information.	CQ: Ontology: Issues:

Timeliness

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QC29 Timeliness means having information available to decision-makers in time to be capable of influencing their decisions. Generally, the older the information is the less useful it is. However, some information may continue to be timely long after the end of a reporting period because, for example, some users may need to identify and assess trends.	CQ: This requirement has to do with the information contained within a FR as well as when the FR was made available / published. Ontology: For the purpose of the ontology, formally defining what is meant with time concepts such as Present ,

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	<p>DateOfReporting etc will assist with the requirement of timeliness.</p> <p>Issues: Timeliness is relative – even if some information is ‘old’ it may still be relevant and timely.</p>

Understandability

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<p>QC30 Classifying, characterising and presenting information clearly and concisely makes it understandable.</p>	<p>CQ: Understandability is one of the basic competency questions of the CFFRO</p> <p>Ontology: Issues:</p>
<p>QC31 Some phenomena are inherently complex and cannot be made easy to understand. Excluding information about those phenomena from financial reports might make the information in those financial reports easier to understand. However, those reports would be incomplete and therefore potentially misleading.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC32 Financial reports are prepared for users who have a reasonable knowledge of business and economic activities and who review and analyse the information diligently. At times, even well-informed and diligent users may need to seek the aid of an adviser to understand information about complex economic phenomena.</p>	<p>CQ: Ontology: Issues:</p>

Applying the enhancing qualitative characteristics

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<p>QC33 Enhancing qualitative characteristics should be maximised to the extent possible. However, the enhancing qualitative characteristics, either individually or as a group, cannot make information useful if that information is irrelevant or not faithfully represented.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC34 Applying the enhancing qualitative characteristics is an iterative process that does not follow a prescribed order. Sometimes, one enhancing qualitative characteristic may have to be diminished to maximise another qualitative characteristic. For example, a temporary reduction in comparability as a result of prospectively applying a new financial reporting standard may be worthwhile to improve relevance or faithful representation in the longer term. Appropriate disclosures may partially compensate for non-comparability.</p>	<p>CQ: Ontology: Issues:</p>

The cost constraint on useful financial reporting

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<p>QC35 Cost is a pervasive constraint on the information that can be provided by financial reporting. Reporting financial information imposes costs, and it is important that those costs are justified by the benefits of reporting that information. There are several types of costs and benefits to consider.</p>	<p>CQ: Ontology: Issues: Outside the scope of the CFFRO but assisting with the process of constructing FR should assist with addressing the cost constraint.</p>
<p>QC36 Providers of financial information expend most of the effort involved in collecting, processing, verifying and disseminating financial information, but users ultimately bear those costs in the form of reduced returns. Users of financial information also incur costs of analysing and interpreting the information provided. If needed information is not provided, users incur additional costs to obtain that information elsewhere or to estimate it.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC37 Reporting financial information that is relevant and faithfully represents what it purports to represent helps users to make decisions with more confidence. This results in more efficient functioning of capital markets and a lower cost of capital for the economy as a whole. An individual investor, lender or other creditor also receives benefits by making more informed decisions. However, it is not possible for general purpose financial reports to provide all the information that every user finds relevant.</p>	<p>CQ: Ontology: Issues:</p>
<p>QC38 In applying the cost constraint, the Board assesses whether the benefits of reporting particular information are likely to justify the costs incurred to provide and use that information. When applying the cost constraint in developing a proposed financial reporting standard, the Board seeks information from providers of financial information, users, auditors, academics and others about the expected nature and quantity of the</p>	<p>CQ: Ontology: Issues:</p>

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<p>benefits and costs of that standard. In most situations, assessments are based on a combination of quantitative and qualitative information.</p>	
<p>QC39 Because of the inherent subjectivity, different individuals' assessments of the costs and benefits of reporting particular items of financial information will vary. Therefore, the Board seeks to consider costs and benefits in relation to financial reporting generally, and not just in relation to individual reporting entities. That does not mean that assessments of costs and benefits always justify the same reporting requirements for all entities. Differences may be appropriate because of different sizes of entities, different ways of raising capital (publicly or privately), different users' needs or other factors.</p>	<p>CQ: Ontology: Issues:</p>

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Chapter 4: The *Framework* (1989): the remaining text

The remaining text of the Framework for the Preparation and Presentation of Financial Statements (1989) has not been amended to reflect changes made by IAS 1 Presentation of Financial Statements (as revised in 2007).

The remaining text will also be updated when the Board has considered the elements of financial statements and their measurement bases.

UNDERLYING ASSUMPTION

Going concern

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<p>4.1. The financial statements are normally prepared on the assumption that an entity is a going concern and will continue in operation for the foreseeable future. Hence, it is assumed that the entity 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 have to be prepared on a different basis and, if so, the basis used is disclosed.</p>	<p>CQ: The CFfFRO should assist in the going concern concept</p> <p>Ontology:</p> <p>Issues:</p>

The elements of financial statements

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<p>4.2. Financial statements portray the financial effects of transactions and other events by grouping them into broad classes according to their economic characteristics. These broad classes are termed the elements of financial statements. The elements directly related to the measurement of financial position in the balance sheet are assets, liabilities and equity. The elements directly related to the measurement of performance in the income statement are income and expenses. The statement of changes in financial position usually reflects income statement elements and changes in balance sheet elements; accordingly, this Conceptual Framework identifies no elements that are unique to this statement.</p>	<p>CQ: Financial transactions should be grouped in classes according to their unique characteristics. Elements of the financial statements should be defined unambiguously and inherently consistent. Measurement of elements (value) should be defined unambiguously and inherently consistent.</p> <p>Ontology: Element, FinancialPerformance, FinancialPosition, Asset, Liability, Equity</p> <p>Issues: Measurement of elements is not unambiguously defined and inherently consistent. Terminology is not standardised, e.g. Balance sheet and Statement of Financial Position.</p>

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<p>4.3. The presentation of these elements in the balance sheet and the income statement involves a process of sub-classification. For example, assets and liabilities may be classified by their nature or function in the business of the entity in order to display information in the manner most useful to users for purposes of making economic decisions.</p>	<p>CQ: Sub-classes should form part of the CFFRO.</p> <p>Ontology: Claims, Liability, Equity</p> <p>Issues:</p>

Financial position

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<p>4.4. The elements directly related to the measurement of financial position are assets, liabilities and equity. These are defined as follows:</p> <ul style="list-style-type: none"> • 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. • 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. • Equity is the residual interest in the assets of the entity after deducting all its liabilities. 	<p>CQ: The CFFRO should define exactly what is meant with the concepts identified below</p> <p>Ontology: Financial Position Measurement Asset Resource Past Event Future Economic Benefit Economic Benefit Flow Liability Settlement Outflow Equity</p> <p>Issues: As defined when modeling asset, liability and equity.</p>
<p>4.5. The definitions of an asset and a liability identify their essential features but do not attempt to specify the criteria that need to be met before they are recognised in the balance sheet. Thus, the definitions embrace items that are not recognised as assets or liabilities in the balance sheet because they do not satisfy the criteria for recognition discussed in paragraphs 4.37–4.53. In particular, the expectation that future economic benefits will flow to or from an entity must be sufficiently certain to meet the probability criterion in paragraph 4.38 before an asset or liability is recognised.</p>	<p>CQ:</p> <p>Ontology: Asset Liability FutureEconomicBenefit</p> <p>Issues:</p> <ul style="list-style-type: none"> • The definition of asset and liability should be complete enough that its recognition is clear? • The notion is future economic benefit seems to be too ambiguous?
<p>4.6. In assessing whether an item meets the definition of an asset, liability or equity, attention needs to be given to its underlying substance and economic reality and not merely its legal form. Thus, for example, in the case of finance leases, the substance and economic reality are that the lessee acquires the economic benefits of the use of the leased asset for the major part of its useful life in return for entering into an obligation to pay</p>	<p>CQ: Definitions of asset, liability and equity should be based on 'economic reality' and not 'just' legal form.</p>

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<p>for that right an amount approximating to the fair value of the asset and the related finance charge. Hence, the finance lease gives rise to items that satisfy the definition of an asset and a liability and are recognised as such in the lessee's balance sheet.</p>	<p>Ontology: Asset Liability Equity</p> <p>Issues: Notion of 'economic reality', 'fair value' is not defined precisely.</p>
<p>4.7. Balance sheets drawn up in accordance with current IFRSs may include items that do not satisfy the definitions of an asset or liability and are not shown as part of equity. The definitions set out in paragraph 4.4 will, however, underlie future reviews of existing IFRSs and the formulation of further IFRSs.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: Unresolved issues in the domain of financial reporting.</p>

Assets

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<p>4.8. The future economic benefit embodied in an asset is the potential to contribute, directly or indirectly, to the flow of cash and cash equivalents to the entity. The potential may be a productive one that is part of the operating activities of the entity. It may also take the form of convertibility into cash or cash equivalents or a capability to reduce cash outflows, such as when an alternative manufacturing process lowers the costs of production.</p>	<p>CQ:</p> <p>Ontology: FutureEconomicBenefit, Cash, CashEquivalents, Flow, Entity</p> <p>Issues:</p>
<p>4.9. An entity usually employs its assets to produce goods or services capable of satisfying the wants or needs of customers; because these goods or services can satisfy these wants or needs, customers are prepared to pay for them and hence contribute to the cash flow of the entity. Cash itself renders a service to the entity because of its command over other resources.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: Usually too vague to model in an ontology</p>
<p>4.10. The future economic benefits embodied in an asset may flow to the entity in a number of ways. For example, an asset may be:</p> <ul style="list-style-type: none"> • used singly or in combination with other assets in the production of goods or services to be sold by the entity; • exchanged for other assets; • used to settle a liability; or • distributed to the owners of the entity. 	<p>CQ:</p> <p>Ontology: FutureEconomicBenefit</p> <p>Issues: Future economic benefit is vague. See the discussion on the ontology</p>
<p>4.11. Many assets, for example, property, plant and equipment, have a physical form. However, physical form is not essential to the existence of an asset; hence patents and copyrights, for example, are assets if future economic benefits are expected to flow from them to the entity and if they are controlled by the entity.</p>	<p>CQ: All classes of assets should be included in the CFFRO</p> <p>Ontology: Asset defined in the ontology</p> <p>Issues: See the discussion on the problem with the asset definition.</p>
<p>Many assets, for example, receivables and property, are associated with legal rights, including the right of ownership. In</p>	<p>CQ:</p>

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<p>determining the existence of an asset, the right of ownership is not essential; thus, for example, property held on a lease is an asset if the entity controls the benefits which are expected to flow from the property. Although the capacity of an entity to control benefits is usually the result of legal rights, an item may nonetheless satisfy the definition of an asset even when there is no legal control. For example, know-how obtained from a development activity may meet the definition of an asset when, by keeping that know-how secret, an entity controls the benefits that are expected to flow from it.</p>	<p>Ontology: Asset</p> <p>Issues:</p> <ul style="list-style-type: none"> • Asset not necessarily have right of ownership. What is meant by this? • Tied into notion of ‘control’? But an asset is a resource under control of the entity?
<p>The assets of an entity result from past transactions or other past events. Entities normally obtain assets by purchasing or producing them, but other transactions or events may generate assets; examples include property received by an entity from government as part of a programme to encourage economic growth in an area and the discovery of mineral deposits. Transactions or events expected to occur in the future do not in themselves give rise to assets; hence, for example, an intention to purchase inventory does not, of itself, meet the definition of an asset.</p>	<p>CQ:</p> <p>Ontology: Asset</p> <p>Issues: Is entity the same as reporting entity? Standardisation of terminology is needed</p>
<p>There is a close association between incurring expenditure and generating assets but the two do not necessarily coincide. Hence, when an entity incurs expenditure, this may provide evidence that future economic benefits were sought but is not conclusive proof that an item satisfying the definition of an asset has been obtained. Similarly the absence of a related expenditure does not preclude an item from satisfying the definition of an asset and thus becoming a candidate for recognition in the balance sheet; for example, items that have been donated to the entity may satisfy the definition of an asset.</p>	<p>CQ:</p> <p>Ontology: FutureEconomicBenefit, Asset, Expense.</p> <p>Issues: The relation between expenditure and asset should be clear from the definitions of asset and expenditure. If it is not, it is an indication of an ambiguity. The two classes should be disjoint.</p>

Liabilities

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<p>An essential characteristic of a liability is that the entity has a present obligation. An obligation is a duty or responsibility to act or perform in a certain way. Obligations may be legally enforceable as a consequence of a binding contract or statutory requirement. This is normally the case, for example, with amounts payable for goods and services received. Obligations also arise, however, from normal business practice, custom and a desire to maintain good business relations or act in an equitable manner. If, for example, an entity decides as a matter of policy to rectify faults in its products even when these become apparent after the warranty period has expired, the amounts that are expected to be expended in respect of goods already sold are liabilities.</p>	<p>CQ: The CFfFRO should contain all the elements of financial statements.</p> <p>Ontology: Claim, Liability, Obligation, Resource, Asset, Present (time of consideration).</p> <p>Issues: Present too vague, not clear what it refers to. See discussion on the modeling of time. See the discussion on the</p>

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	issues with the liability definition in the ontology.
<p>A distinction needs to be drawn between a present obligation and a future commitment. A decision by the management of an entity to acquire assets in the future does not, of itself, give rise to a present obligation. An obligation normally arises only when the asset is delivered or the entity enters into an irrevocable agreement to acquire the asset. In the latter case, the irrevocable nature of the agreement means that the economic consequences of failing to honour the obligation, for example, because of the existence of a substantial penalty, leave the entity with little, if any, discretion to avoid the outflow of resources to another party.</p>	<p>CQ:</p> <p>Ontology: Time, Present (time of consideration), Obligation, EconomicOutflow</p> <p>Issues: Economic outflow is vague, present obligation is vague, see comments in the ontology. See the discussion on the issues with the liability definition in the ontology.</p>
<p>The settlement of a present obligation usually involves the entity giving up resources embodying economic benefits in order to satisfy the claim of the other party. Settlement of a present obligation may occur in a number of ways, for example, by:</p> <ul style="list-style-type: none"> • payment of cash; • transfer of other assets; • provision of services; • replacement of that obligation with another obligation; or • conversion of the obligation to equity. <p>An obligation may also be extinguished by other means, such as a creditor waiving or forfeiting its rights.</p>	<p>CQ:</p> <p>Ontology: EconomicBenefit, Obligation.</p> <p>Issues: See the discussion on the issues with the liability definition in the ontology.</p>
<p>Liabilities result from past transactions or other past events. Thus, for example, the acquisition of goods and the use of services give rise to trade payables (unless paid for in advance or on delivery) and the receipt of a bank loan results in an obligation to repay the loan. An entity may also recognise future rebates based on annual purchases by customers as liabilities; in this case, the sale of the goods in the past is the transaction that gives rise to the liability.</p>	<p>CQ:</p> <p>Ontology: Liability, claim, past event.</p> <p>Issues: See the discussion on the issues with the liability definition in the ontology.</p>
<p>Some liabilities can be measured only by using a substantial degree of estimation. Some entities describe these liabilities as provisions. In some countries, such provisions are not regarded as liabilities because the concept of a liability is defined narrowly so as to include only amounts that can be established without the need to make estimates. The definition of a liability in paragraph 4.4 follows a broader approach. Thus, when a provision involves a present obligation and satisfies the rest of the definition, it is a liability even if the amount has to be estimated. Examples include provisions for payments to be made under existing warranties and provisions to cover pension obligations.</p>	<p>CQ:</p> <p>Ontology: Measurement, Liability, Claim, Obligation.</p> <p>Issues: Discussion on measurement in the CFfFR is still incomplete and not sufficient. Estimation must be clearly defined.</p>

Equity

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<p>Although equity is defined in paragraph 4.4 as a residual, it may be sub-classified in the balance sheet. For example, in a corporate entity, funds contributed by shareholders, retained earnings, reserves representing appropriations of retained earnings and reserves representing capital maintenance adjustments may be shown separately. Such classifications can be relevant to the decision-making needs of the users of financial statements when they indicate legal or other restrictions on the ability of the entity to distribute or otherwise apply its equity. They may also reflect the fact that parties with ownership interests in an entity have differing rights in relation to the receipt of dividends or the repayment of contributed equity</p>	<p>CQ: Definitions of elements should be clear and unambiguous.</p> <p>Ontology: Claim, equity, obligation, no-obligation, shareholder.</p> <p>Issues: The current definition of equity cannot be modeled. See the discussion in the CFFRO.</p>
<p>The creation of reserves is sometimes required by statute or other law in order to give the entity and its creditors an added measure of protection from the effects of losses. Other reserves may be established if national tax law grants exemptions from, or reductions in, taxation liabilities when transfers to such reserves are made. The existence and size of these legal, statutory and tax reserves is information that can be relevant to the decision-making needs of users. Transfers to such reserves are appropriations of retained earnings rather than expenses.</p>	<p>CQ:</p> <p>Ontology: Retained earnings</p> <p>Issues: Retained earnings is not defined in the CFFR. A decision is made to classify it as a sub-class of equity.</p>
<p>The amount at which equity is shown in the balance sheet is dependent on the measurement of assets and liabilities. Normally, the aggregate amount of equity only by coincidence corresponds with the aggregate market value of the shares of the entity or the sum that could be raised by disposing of either the net assets on a piecemeal basis or the entity as a whole on a going concern basis.</p>	<p>CQ:</p> <p>Ontology: Equity, Asset, Liability, value</p> <p>Issues:</p> <ul style="list-style-type: none"> • As a class equity is disjoint from asset and liability. The dependence of the value of equity on the measurement values of assets and liabilities indicates an inconsistency in the ontology. • A decision is made that amount and value refers to the same class.
<p>Commercial, industrial and business activities are often undertaken by means of entities such as sole proprietorships, partnerships and trusts and various types of government business undertakings. The legal and regulatory framework for such entities is often different from that applying to corporate entities. For example, there may be few, if any, restrictions on the distribution to owners or other beneficiaries of amounts included in equity. Nevertheless, the definition of equity and the other aspects of this Conceptual Framework that deal with equity are appropriate for such entities.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: As the section on reporting entity is still outstanding it is not possible to formalise the effect of different types of reporting entities.</p>

Performance

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>Profit is frequently used as a measure of performance or as the basis for other measures, such as return on investment or earnings per share. The elements directly related to the measurement of profit are income and expenses. The recognition and measurement of income and expenses, and hence profit, depends in part on the concepts of capital and capital maintenance used by the entity in preparing its financial statements. These concepts are discussed in paragraphs 4.57–4.65.</p>	<p>CQ: The CFfFRO should provide information regarding the profit of a reporting entity.</p> <p>Ontology: Element, Income, Expense, Profit, FinancialPerformance, FinancialStatement, FinancialReport, Measurement, Value</p> <p>Issues: It is unclear if this section refers to certain financial statements or to the financial report. See previous comments on measurement and the absence of the term “value” from the CFfFR.</p>
<p>The elements of income and expenses are defined as follows:</p> <p>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. Expenses are decreases in economic benefits during the accounting period in the form of outflows or depletions of assets or incurrences of liabilities that result in decreases in equity, other than those relating to distributions to equity participants.</p>	<p>CQ:</p> <ul style="list-style-type: none"> • Financial transactions should be grouped in classes according to their unique characteristics. • Elements of the financial statements should be defined unambiguously and inherently consistent. • Measurement of elements (value) should be defined unambiguously and inherently consistent. <p>Ontology: Income, Economic benefit, time, inflow, asset, liability, equity, shareholder, expense, outflow, increase, decrease.</p> <p>Issues:</p> <ul style="list-style-type: none"> • See the issues in the CFfFRO regarding the formalisation of the definitions for income and expense. • The definitions of income and expense resulted in inconsistencies if they are labelled as disjoint from asset, liability and equity. • It is not asset, liability or equity that increase or decrease, but the values of these elements. • Standardisation of terminology is needed.

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	<ul style="list-style-type: none"> • Is an equity participant the same as a shareholder or an owner? • What accounting period are the definitions referring to? • A decision was made that it refers to the past accounting period. • Is it possible that it can refer to a future accounting period given the accrual accounting concept? • The definitions should be more precise?
<p>The definitions of income and expenses identify their essential features but do not attempt to specify the criteria that would need to be met before they are recognised in the income statement. Criteria for the recognition of income and expenses are discussed in paragraphs 4.37–4.53.</p>	<p>CQ: Ontology: Issues:</p>
<p>Income and expenses may be presented in the income statement in different ways so as to provide information that is relevant for economic decision-making. For example, it is common practice to distinguish between those items of income and expenses that arise in the course of the ordinary activities of the entity and those that do not. This distinction is made on the basis that the source of an item is relevant in evaluating the ability of the entity to generate cash and cash equivalents in the future; for example, incidental activities such as the disposal of a long-term investment are unlikely to recur on a regular basis. When distinguishing between items in this way consideration needs to be given to the nature of the entity and its operations. Items that arise from the ordinary activities of one entity may be unusual in respect of another.</p>	<p>CQ: Ontology: Issues:</p> <ul style="list-style-type: none"> • “Information that is relevant for economic decision making” is not precise and can be interpreted in various ways. • Does entity refers to reporting entity?
<p>Distinguishing between items of income and expense and combining them in different ways also permits several measures of entity performance to be displayed. These have differing degrees of inclusiveness. For example, the income statement could display gross margin, profit or loss from ordinary activities before taxation, profit or loss from ordinary activities after taxation, and profit or loss</p>	<p>CQ: Ontology: FinancialPerformance Issues:</p> <ul style="list-style-type: none"> • New terminologies are introduced without defining them e.g. gross margin. It is an indication of implied knowledge. • “Degrees of inclusiveness” is ambiguous and should be clearly defined.

Income

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>The definition of income encompasses both revenue and gains. Revenue arises in the course of the ordinary activities of an entity and is referred to by a variety of different names including sales, fees, interest, dividends, royalties and rent</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • Is revenue the same as income, sales, fees, interest, dividends, royalties and rent? • Is it the same class or sub-classes of a super-class? • Are these just different names for the same class? • The section is ambiguous and the relation between the classes must be indicated. A lot of domain knowledge is assumed.
<p>Gains represent other items that meet the definition of income and may, or may not, arise in the course of the ordinary activities of an entity. Gains represent increases in economic benefits and as such are no different in nature from revenue. Hence, they are not regarded as constituting a separate element in this Conceptual Framework.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • The discussion on gains is ambiguous. It is not possible to formalise the class gain from the description provided. • The document states that “gains represent increases in economic benefits and as such are no different in nature from revenue?” • Should gains be classified as a sub-class of income? • What is the relation between gains, revenue, sales, fees, interest, dividends, royalties and rent? • The concept gain should be defined clearly. • How was it determined that the information related to gains will provide useful information to users?
<p>Gains include, for example, those arising on the disposal of non-current assets. The definition of income also includes unrealised gains; for example, those arising on the revaluation of marketable securities and those resulting from increases in the carrying amount of long-term assets. When gains are recognised in the income statement, they are usually displayed separately because knowledge of them is useful for the purpose of making economic decisions. Gains are often reported net of related expenses</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • A new concept “unrealized gains” is introduced. How it unrealized gains related to gains? • A clear definition of gains and unrealized gains are needed in order to formalise the concept.
<p>Various kinds of assets may be received or enhanced by income; examples include cash, receivables and goods and services received in exchange for goods and services supplied. Income may also result from the settlement of liabilities. For</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>

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<p>example, an entity may provide goods and services to a lender in settlement of an obligation to repay an outstanding loan.</p>	<ul style="list-style-type: none"> • How is it possible that an asset can be enhanced by income? • Domain knowledge is assumed. • It should be the value of the an asset that can be increased by an increase in income value.

Expenses

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>The definition of expenses encompasses losses as well as those expenses that arise in the course of the ordinary activities of the entity. Expenses that arise in the course of the ordinary activities of the entity include, for example, cost of sales, wages and depreciation. They usually take the form of an outflow or depletion of assets such as cash and cash equivalents, inventory, property, plant and equipment.</p>	<p>CQ:</p> <p>Ontology: Expense, Asset.</p> <p>Issues:</p> <ul style="list-style-type: none"> • See comments on the value of assets above. • A new term “losses” is introduced without any explanation. • What is the relation between expenses and losses? • How does the definition of expenses “encompasses” losses? • Domain knowledge is assumed.
<p>Losses represent other items that meet the definition of expenses and may, or may not, arise in the course of the ordinary activities of the entity. Losses represent decreases in economic benefits and as such they are no different in nature from other expenses. Hence, they are not regarded as a separate element in this Conceptual Framework.</p>	<p>CQ:</p> <p>Ontology: EconomicBenefit, Expense</p> <p>Issues:</p> <ul style="list-style-type: none"> • “Other items” is vague and not defined. • What are the meeting the definition of expenses that are not “other items”. • The formulation should be more specific.
<p>Losses include, for example, those resulting from disasters such as fire and flood, as well as those arising on the disposal of non-current assets. The definition of expenses also includes unrealised losses, for example, those arising from the effects of increases in the rate of exchange for a foreign currency in respect of the borrowings of an entity in that currency. When losses are recognised in the income statement, they are usually displayed separately because knowledge of them is useful for the purpose of making economic decisions. Losses are often reported net of related income.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • “Unrealised losses” is not defined and cannot be formalised.

Capital maintenance adjustments

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<p>The revaluation or restatement of assets and liabilities gives rise to increases or decreases in equity. While these increases or decreases meet the definition of income and expenses, they are not included in the income statement under certain concepts of capital maintenance. Instead these items are included in equity as capital maintenance adjustments or revaluation reserves. These concepts of capital maintenance are discussed in paragraphs 4.57–4.65 of this Conceptual Framework.</p>	<p>CQ:</p> <p>Ontology: This concept is not formalised at this stage.</p> <p>Issues:</p>

Recognition of the elements of financial statements

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<p>Recognition is the process of incorporating in the balance sheet or income statement an item that meets the definition of an element and satisfies the criteria for recognition set out in paragraph 4.38. It involves the depiction of the item in words and by a monetary amount and the inclusion of that amount in the balance sheet or income statement totals. Items that satisfy the recognition criteria should be recognised in the balance sheet or income statement. The failure to recognise such items is not rectified by disclosure of the accounting policies used nor by notes or explanatory material.</p>	<p>CQ:</p> <p>Ontology: Value,</p> <p>Issues: Terminology is not standardised with the new sections of the CFfFR.</p>
<p>An item that meets the definition of an element should be recognised if:</p> <ul style="list-style-type: none"> • it is probable that any future economic benefit 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. 	<p>CQ:</p> <p>Ontology: Probable, FutureEconomicBenefit, Reporting Entity, Inflow (flow to), Measure.</p> <p>Issues:</p>
<p>In assessing whether an item meets these criteria and therefore qualifies for recognition in the financial statements, regard needs to be given to the materiality considerations discussed in Chapter 3 Qualitative characteristics of useful financial information. The interrelationship between the elements means that an item that meets the definition and recognition criteria for a particular element, for example, an asset, automatically requires the recognition of another element, for example, income or a liability.</p>	<p>CQ: The competency questions should ensure that information complies with the qualitative characteristics.</p> <p>Ontology:</p> <p>Issues:</p>

The probability of future economic benefit

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<p>The concept of probability is used in the recognition criteria to refer to the degree of uncertainty that the future economic benefits associated with the item will flow to or from the entity. The concept is in keeping with the uncertainty that characterises the environment in which an entity operates. Assessments of the degree of uncertainty attaching to the flow of future economic benefits are made on the basis of the evidence available when the financial statements are prepared. For example, when it is probable that a receivable owed to an entity will be paid, it is then justifiable, in the absence of any evidence to the contrary, to recognise the receivable as an asset. For a large population of receivables, however, some degree of non-payment is normally considered probable; hence an expense representing the expected reduction in economic benefits is recognized.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues: The concept probability is vague and difficult to formalise.</p>

Reliability of measurement

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<p>The second criterion for the recognition of an item is that it possesses a cost or value that can be measured with reliability. In many cases, cost or value must be estimated; the use of reasonable estimates is an essential part of the preparation of financial statements and does not undermine their reliability. When, however, a reasonable estimate cannot be made the item is not recognised in the balance sheet or income statement. For example, the expected proceeds from a lawsuit may meet the definitions of both an asset and income as well as the probability criterion for recognition; however, if it is not possible for the claim to be measured reliably, it should not be recognised as an asset or as income; the existence of the claim, however, would be disclosed in the notes, explanatory material or supplementary schedules.</p>	<p>CQ:</p> <p>Ontology: Measurement, Value</p> <p>Issues:</p> <ul style="list-style-type: none"> • See comments on value and measurement. The information regarding value and measurement is incomplete in the CFfFR.
<p>An item that, at a particular point in time, fails to meet the recognition criteria in paragraph 4.38 may qualify for recognition at a later date as a result of subsequent circumstances or events.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>An item that possesses the essential characteristics of an element but fails to meet the criteria for recognition may nonetheless warrant disclosure in the notes, explanatory material or in supplementary schedules. This is appropriate when knowledge of the item is considered to be relevant to the evaluation of the financial position, performance and changes in financial position of an entity by the users of financial statements.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>

Recognition of assets

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<p>An asset is recognised in the balance sheet when it is probable that the future economic benefits will flow to the entity and the asset has a cost or value that can be measured reliably.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • Asset is not recognised – the value is recognised?
<p>An asset is not recognised in the balance sheet when expenditure has been incurred for which it is considered improbable that economic benefits will flow to the entity beyond the current accounting period. Instead such a transaction results in the recognition of an expense in the income statement. This treatment does not imply either that the intention of management in incurring expenditure was other than to generate future economic benefits for the entity or that management was misguided. The only implication is that the degree of certainty that economic benefits will flow to the entity beyond the current accounting period is insufficient to warrant the recognition of an asset.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • How is this improbability measured that results in the non-definition of an asset?

Recognition of liabilities

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<p>A liability is recognised in the balance sheet when it is probable that an outflow of resources embodying economic benefits will result from the settlement of a present obligation and the amount at which the settlement will take place can be measured reliably. In practice, obligations under contracts that are equally proportionately unperformed (for example, liabilities for inventory ordered but not yet received) are generally not recognised as liabilities in the financial statements. However, such obligations may meet the definition of liabilities and, provided the recognition criteria are met in the particular circumstances, may qualify for recognition. In such circumstances, recognition of liabilities entails recognition of related assets or expenses.</p>	<p>CQ:</p> <p>Ontology: Outflow, Elements, Liability, Value</p> <p>Issues:</p> <ul style="list-style-type: none"> • Liability is not recognized – the value is recognised? • See the CFFRO with the discussion on the definition of a liability regarding the problem with outflow of resources.

Recognition of income

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<p>Income is recognised in the income statement when an increase in future economic benefits related to an increase in an asset or a decrease of a liability has arisen that can be measured reliably. This means, in effect, that recognition of income occurs simultaneously with the recognition of increases in assets or decreases in liabilities (for example, the net increase in assets arising on a sale of goods or services or the decrease in liabilities arising from the waiver of a debt payable).</p>	<p>CQ:</p> <p>Ontology: FutureEconomicBenefit, Asset, Liability, Inflow</p> <p>Issues:</p>
<p>The procedures normally adopted in practice for recognising income, for example, the requirement that revenue should be earned, are applications of the recognition criteria in this Conceptual Framework. Such procedures are generally directed at restricting the recognition as income to those items that can be measured reliably and have a sufficient degree of certainty.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>

Recognition of expenses

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<p>Expenses are recognised in the income statement when a decrease in future economic benefits related to a decrease in an asset or an increase of a liability has arisen that can be measured reliably. This means, in effect, that recognition of expenses occurs simultaneously with the recognition of an increase in liabilities or a decrease in assets (for example, the accrual of employee entitlements or the depreciation of equipment).</p>	<p>CQ:</p> <p>Ontology: FutureEconomicBenefit, Asset, Liability, Decrease, Measurement</p> <p>Issues:</p>
<p>Expenses are recognised in the income statement on the basis of a direct association between the costs incurred and the earning of specific items of income. This process, commonly referred to as the matching of costs with revenues, involves the simultaneous or combined recognition of revenues and expenses that result directly and jointly from the same transactions or other events; for example, the various components of expense making up the cost of goods sold are recognised at the same time as the income derived from the sale of the goods. However, the application of the matching concept under this Conceptual Framework does not allow the recognition of items in the balance sheet which do not meet the definition of assets or liabilities.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>When economic benefits are expected to arise over several accounting periods and the association with income can only be broadly or indirectly determined, expenses are recognised in the income statement on the basis of systematic and rational allocation procedures. This is often necessary in recognising the expenses associated with the using up of assets such as property, plant, equipment, goodwill, patents and trademarks; in such cases the expense is referred to as depreciation or amortisation. These allocation procedures are intended to recognise expenses in the accounting periods in which the economic benefits associated with these items are consumed or expire.</p>	<p>CQ:</p> <p>Ontology: Time, Future, Past, Expense, Income, EconomicBenefit.</p> <p>Issues:</p>

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<p>An expense is recognised immediately in the income statement when an expenditure produces no future economic benefits or when, and to the extent that, future economic benefits do not qualify, or cease to qualify, for recognition in the balance sheet as an asset.</p>	<p>CQ:</p> <p>Ontology: FutureEconomicBenefit</p> <p>Issues:</p>
<p>An expense is also recognised in the income statement in those cases when a liability is incurred without the recognition of an asset, as when a liability under a product warranty arises.</p>	<p>CQ:</p> <p>Ontology: Expense, Liability</p> <p>Issues:</p>

Measurement of the elements of financial statements

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<p>Measurement is the process of determining the monetary amounts at which the elements of the financial statements are to be recognised and carried in the balance sheet and income statement. This involves the selection of the particular basis of measurement.</p>	<p>CQ: Elements of the financial statements must be measured and a value allocated to them.</p> <p>Ontology: Value</p> <p>Issues:</p> <ul style="list-style-type: none"> • Decision, monetary amounts represents the value of the elements.
<p>A number of different measurement bases are employed to different degrees and in varying combinations in financial statements. They include the following: Historical cost. Assets are recorded at the amount of cash or cash equivalents paid or the fair value of the consideration given to acquire them at the time of their acquisition. Liabilities are recorded at the amount of proceeds received in exchange for the obligation, or in some circumstances (for example, income taxes), at the amounts of cash or cash equivalents expected to be paid to satisfy the liability in the normal course of business. Current cost. Assets are carried at the amount of cash or cash equivalents that would have to be paid if the same or an equivalent asset was acquired currently. Liabilities are carried at the undiscounted amount of cash or cash equivalents that would be required to settle the obligation currently. Realisable (settlement) value. Assets are carried at the amount of cash or cash equivalents that could currently be obtained by selling the asset in an orderly disposal. Liabilities are carried at their settlement values; that is, the undiscounted amounts of cash or cash equivalents expected to be paid to satisfy the liabilities in the normal course of business. Present value. Assets are carried at the present discounted value of the future net cash inflows that the item is expected to generate in the normal course of business. 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. The measurement basis most commonly adopted by entities in</p>	<p>CQ:</p> <p>Ontology: HistoricalCost, CurrentCost RealisableValue PresentValue</p> <p>Issues:</p> <ul style="list-style-type: none"> • The measurement section is under revision. • At this stage it is sufficient to mention that elements should be measured in order to be included in one of the financial statements. • See the issues with measurement during the formalisation of the elements of the SFP.

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<p>preparing their financial statements is historical cost. This is usually combined with other measurement bases. For example, inventories are usually carried at the lower of cost and net realisable value, marketable securities may be carried at market value and pension liabilities are carried at their present value. Furthermore, some entities use the current cost basis as a response to the inability of the historical cost accounting model to deal with the effects of changing prices of non-monetary assets.</p>	

CONCEPTS OF CAPITAL AND CAPITAL MAINTENANCE

Concepts of capital

CONCEPTUAL FRAMEWORK FOR FINANCIAL REPORTING – NATURAL TEXT AS PUBLISHED BY THE IASB	ANALYSIS OF THE NATURAL TEXT FOR THE PURPOSE OF THE ONTOLOGY
<p>A financial concept of capital is adopted by most entities in preparing their financial statements. Under a financial concept of capital, such as invested money or invested purchasing power, capital is synonymous with the net assets or equity of the entity. Under a physical concept of capital, such as operating capability, capital is regarded as the productive capacity of the entity based on, for example, units of output per day.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p> <ul style="list-style-type: none"> • Is the section on the concept of capital and capital maintenance necessary if equity is consistently and unambiguously defined? • What is the relation between the concepts capital, equity and net asset value? • Should capital, equity and net asset value be different classes that needs to be formalised? • What is the meaning of “a physical concept of capital”?
<p>The selection of the appropriate concept of capital by an entity should be based on the needs of the users of its financial statements. Thus, a financial concept of capital should be adopted if the users of financial statements are primarily concerned with the maintenance of nominal invested capital or the purchasing power of invested capital. If, however, the main concern of users is with the operating capability of the entity, a physical concept of capital should be used. The concept chosen indicates the goal to be attained in determining profit, even though there may be some measurement difficulties in making the concept operational.</p>	<p>CQ:</p> <p>Ontology: Financial Capital, Physical Capital</p> <p>Issues:</p> <ul style="list-style-type: none"> • Are these terms still relevant and how would it influence the financial report?

Concepts of capital maintenance and the determination of profit

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<p>The concepts of capital in paragraph 4.57 give rise to the following concepts of capital maintenance:</p> <p>Financial capital maintenance. Under this concept a profit is earned only if the financial (or money) amount of the net assets at the end of the period exceeds the financial (or money) amount of net assets at the beginning of the period, after excluding any distributions to, and contributions from, owners during the period. Financial capital maintenance can be measured in either nominal monetary units or units of constant purchasing power.</p> <p>Physical capital maintenance. Under this concept a profit is earned only if the physical productive capacity (or operating capability) of the entity (or the resources or funds needed to achieve that capacity) at the end of the period exceeds the physical productive capacity at the beginning of the period, after excluding any distributions to, and contributions from, owners during the period.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>The concept of capital maintenance is concerned with how an entity defines the capital that it seeks to maintain. It provides the linkage between the concepts of capital and the concepts of profit because it provides the point of reference by which profit is measured; it is a prerequisite for distinguishing between an entity's return on capital and its return of capital; only inflows of assets in excess of amounts needed to maintain capital may be regarded as profit and therefore as a return on capital. Hence, profit is the residual amount that remains after expenses (including capital maintenance adjustments, where appropriate) have been deducted from income. If expenses exceed income the residual amount is a loss.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>The physical capital maintenance concept requires the adoption of the current cost basis of measurement. The financial capital maintenance concept, however, does not require the use of a particular basis of measurement. Selection of the basis under this concept is dependent on the type of financial capital that the entity is seeking to maintain.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>The principal difference between the two concepts of capital maintenance is the treatment of the effects of changes in the prices of assets and liabilities of the entity. In general terms, an entity has maintained its capital if it has as much capital at the end of the period as it had at the beginning of the period. Any amount over and above that required to maintain the capital at the beginning of the period is profit.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>Under the concept of financial capital maintenance where capital is defined in terms of nominal monetary units, profit represents the increase in nominal money capital over the period. Thus, increases in the prices of assets held over the period, conventionally referred to as holding gains, are, conceptually, profits. They may not be recognised as such, however, until the assets are disposed of in an exchange transaction. When the concept of financial capital maintenance is defined in terms of constant purchasing power units, profit represents the increase in invested purchasing power over the period. Thus, only that part of the increase in the prices of assets that exceeds the increase in the general level of prices is regarded as profit. The rest of the increase is treated as a capital maintenance adjustment and, hence, as part of equity.</p>	<p>CQ:</p> <p>Ontology:</p> <p>Issues:</p>
<p>Under the concept of physical capital maintenance when capital is defined in terms of the physical productive capacity, profit</p>	<p>CQ:</p>

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<p>represents the increase in that capital over the period. All price changes affecting the assets and liabilities of the entity are viewed as changes in the measurement of the physical productive capacity of the entity; hence, they are treated as capital maintenance adjustments that are part of equity and not as profit.</p>	<p>Ontology: Issues:</p>
<p>The selection of the measurement bases and concept of capital maintenance will determine the accounting model used in the preparation of the financial statements. Different accounting models exhibit different degrees of relevance and reliability and, as in other areas, management must seek a balance between relevance and reliability. This Conceptual Framework is applicable to a range of accounting models and provides guidance on preparing and presenting the financial statements constructed under the chosen model. At the present time, it is not the intention of the Board to prescribe a particular model other than in exceptional circumstances, such as for those entities reporting in the currency of a hyperinflationary economy. This intention will, however, be reviewed in the light of world developments.</p>	<p>CQ: Ontology: Issues:</p>

12.5 Appendix E – Ontology Engineering Decisions

Included in the main document

13 REFERENCES

Wikipedia. (2014a). Financial crisis. Retrieved February 18, 2014, from http://en.wikipedia.org/wiki/Financial_crisis#20th_century

Wikipedia. (2014b). List of corporate collapses and scandals. Retrieved February 18, 2014, from http://en.wikipedia.org/wiki/List_of_corporate_collapses_and_scandals

Wikipedia. (2014c). List of stock market crashes and bear markets. Retrieved February 18, 2014, from [http://en.wikipedia.org/wiki/List_of_stock_market_crashes_and_bear_m
arkets](http://en.wikipedia.org/wiki/List_of_stock_market_crashes_and_bear_markets)