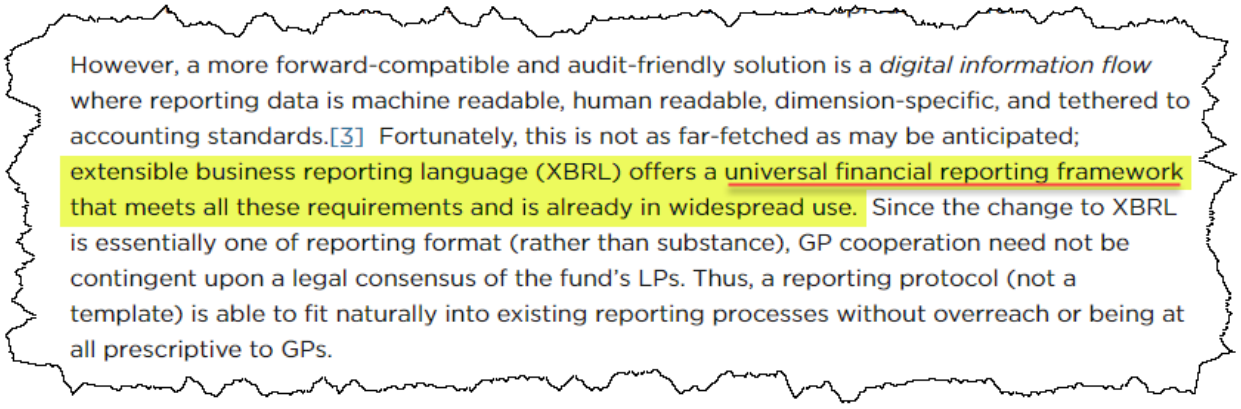
Ten Keys to Creating a Universal Digital Financial Reporting Framework

As explained in the book *The Great Upheaval*[1], the world is in the midst of a "great upheaval" where the world is transitioning from an analog, industrial economy to a digital, knowledge economy.

The article, *An Economic Case for Transparency in Private Equity*[2], which is an abridged version of the academic paper, *An Economic Case for Transparency in Private Equity: Data Science, Interest Alignment and Organic Finance*[3], points out that XBRL offers the opportunity to create a **Universal Digital Financial Reporting Framework**.



This document points out ten keys to making this transformation to digital general purpose financial reporting effectively and enabling what would amount to a universal digital financial reporting framework[4].

Key 1: Accounting and Reporting Rules Served by Immutable Standards based Machine Readable Declarative Rules

The coming transformation of financial reporting requires some of the rules and regulations related to financial accounting and financial reporting to be represented in an immutable standards-based machine-readable declarative form.

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[1] Author Levine and Scott J. van Pelt, *The Great Upheaval*, https://www.amazon.com/Great-Upheaval-Educations-Present-Uncertain/dp/1421442574

[2] Ashby Monk, Sheridan Porter, Rajiv Sharma, *An Economic Case for Transparency in Private Equity*, https://caia.org/blog/2021/11/07/economic-case-transparency-private-equity

[3] Ashby Monk, Sheridan Porter, Rajiv Sharma, *An Economic Case for Transparency in Private Equity: Data Science, Interest Alignment and Organic Finance*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3931906

[4] *Universal Digital Financial Reporting Framework*, http://xbrl.squarespace.com/journal/2021/3/4/universal-digital-financial-reporting-framework.html

Rules and regulations, some of them not all of them, can be represented in machine-readable form using a global standard, such as XBRL, placed on the Inter-Planetary File System[5] (IPFS) so they will always be available, be instantiated as an NFT, or non-fungible token, and then reliably used by software applications. This article, *What Are NTFs and How Do They Work*[6], points out these characteristics of NFTs which help you understand what they are:

- **Non-interoperable**: NFTs are unique and unlike fungible tokens which are all the same basically and any one is just as good as any other; NFTs are not interchangeable.
- **Indivisible**: NFTs cannot be divided into smaller denominations.
- **Indestructible**: NFTs are stored on the blockchain and can never be destroyed.
- **Verifiable**: Because NFTs exist on a blockchain they can be traced back to the original creator.

However, this does not subordinate accountants, reporting entities, auditors, financial analysts, investors, standards setters or regulators and the rules and regulations to the constraints of computer science. The information communicated by a financial report and the rules and regulations that govern such reports is, and always will be, the legal agreement, not the computer code. The code can only refer to, or facilitate the transmission of, those professional work products that bring a financial report into being. It does not seem productive to attempt to translate legal and regulatory technical complexity into code when adjudication, in the case of default, will revert not to code but to the judiciary.

As pointed out by the *Business Rules Manifesto*, Article 4[7];

- Rules should be expressed declaratively in natural-language sentences for the business audience.
- If something cannot be expressed, then it is not a rule.
- A set of statements is declarative only if the set has no implicit sequencing.
- Any statements of rules that require constructs other than terms and facts imply assumptions about a system implementation.
- A rule is distinct from any enforcement defined for it. A rule and its enforcement are separate concerns.
- Rules should be defined independently of responsibility for the who, where, when, or how of their enforcement. Rulemaking is a separate responsibility from rule enforcement.
- Exceptions to rules are expressed by other rules.

[5] IPFS.io, *How IPFS Works*, https://ipfs.io/#how
[6] Coindesk, *What are NFTs and How Do They Work*, https://www.coindesk.com/what-are-nfts
[7] Business Rules Group, Business Rules Manifesto, Article 4, https://www.businessrulesgroup.org/brmanifesto.htm

Key 2: Ease of Use is Required

Digital financial reporting will only emerge if the technology developers allow those market participants that create, read, or otherwise make use of such digital financial reports like accountants, business professionals, investors, auditors, financial analysts, regulators, data aggregators, attorneys, and commercial loan officers, who are not computer scientists or coders, and never want to be computer scientists or coders. Software in support of digital financial reporting must be built around the needs of its users.

Notwithstanding the digitization of the "paper" process or "e-paper" such as PDF, HTML, word processing documents, creating digital financial reports requires that existing workflows, business processes, audits, and financial analysis be maintained in a way that users can accept, understand, and integrate into existing processes. The widespread adoption of blockchain technology in financial reporting is dependent on an expansion of the user base amongst existing practitioners in the marketplace. This will require digitization of these financial reporting related artifacts in a way that is accessible to all participants that are involved in this process.

Ease of use is required by taking the complexities of digital financial reporting and burying those complexities within software applications or within platforms that serve those software applications and their users. Creative and clever use of explainable rules-based artificial intelligence by software engineers can simplify software use.

Simplistic software will not do. Attempting to remove what might be considered a complex or sophisticated task or process from software to make developing such software easier will never be acceptable. The law of irreducible complexity mandates that all necessary parts of the system exist.

Key 3: Clear, Understandable Accounting and Reporting Logic

The terminology, rules, and other logic used in accounting and financial reporting must be clear and understandable because computers simply cannot work effectively with ambiguity.

Remember, computers are machines. Computers have no intelligence until they are instructed by humans. Computers only appear smart when humans create standards and agree to do things in a similar manner in order to achieve some higher purpose. A machine such as a computer can only mimic what humans tell the machine to do via machine-readable information.

A logical system enables a community of stakeholders trying to achieve a specific goal or objective or a range of goals/objectives to agree on important common models, structures, and statements for capturing meaning or representing a shared understanding of and knowledge in

some area of knowledge. Such logical systems can be explained using a logical theory. Logical theories can be tested to prove if the theory described is true of false.

A financial report is a logical system. Financial reports represent economic events, activities, and other circumstances in words and numbers. A financial report is a true and fair representation of a set of claims made by an economic entity about the financial position and financial performance of that economic entity. Financial reports are not arbitrary, not random, and not illogical.

A logical theory is made up of a set of logical models, logical structures, logical terms, logical associations, logical rules, and logical facts. Such logic must be clear and understandable.

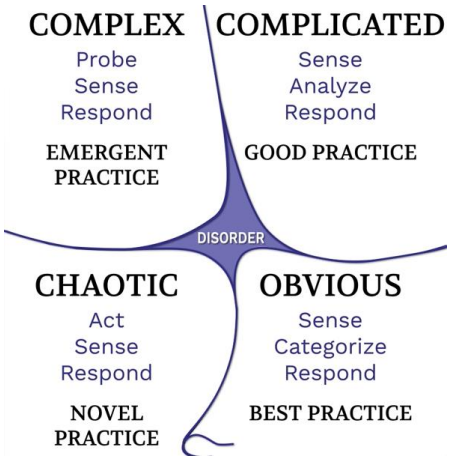
Key 4: Good Practices and Best Practices

An area of knowledge is a highly organized socially constructed aggregation of shared knowledge for a distinct subject matter. An area of knowledge has a specialized insider vocabulary, jargon, underlying assumptions (axioms, theorems, constraints), and persistent open questions that have not necessarily been resolved (i.e. flexibility is necessary).

Accounting is an area of knowledge. You can explain aspects of the accounting area of knowledge, such as the nature of a financial report, using a logical theory which explains a logical model. A logical theory can be tested and proven by providing a proof.

Knowledge can be represented in human-readable form, in machine-readable form, or in a machine-readable form that can be effectively converted into human-readable form.

The knowledge within an area of knowledge can be explained using tools such as the Cynefin Framework[8] which is a sensemaking process[9].



[8] YouTube.com, CognitiveEdge, *Cynefin Framework*, https://youtu.be/N7oz366X0-8
[9] Wikipedia, *Sensemaking*, https://en.wikipedia.org/wiki/Sensemaking

Some accounting knowledge related to the repetitive, mechanical, mathematical, and logical aspects of accounting, reporting, auditing, and analysis are obvious and can be explained in terms of "best practices" or are complicated and can be analyzed by those with accounting expertise and explained as a set of "good practices". There are other frameworks similar to Cynefin that help one make sense of things[10] such as ISO-9000 quality frameworks.

Key 5: Clear, Understandable Terms, Associations, Rules, Facts

Double entry bookkeeping is an ancient best practices technique that is in global use today and commerce and global multinational organizations could not exist without that ancient best practice[11]. Double entry bookkeeping is a mathematical model[12]. That double entry bookkeeping mathematical model is the foundation for robust financial reporting schemes such as U.S. Generally Accepted Accounting Principles[13] (US GAAP) and International Financial Reporting Standards[14] (IFRS) among others[15]. Both US GAAP and IFRS are grounded in a version of the accounting equation[16]. Both US GAAP[17] and IFRS[18] define a core set of interrelated elements of financial statements that form a conceptual framework for financial reporting using that financial reporting framework. The semantics of US GAAP has been maturing for almost 100 years and IFRS for almost 50 years.

These interrelated elements of financial statements are the building blocks with which financial statements are constructed. Both US GAAP and IFRS discuss the notions of "articulation" which relates to the intentional interconnectedness of each of the primary financial statements and "intermediate components" which relates to the notion that different reporting entities are permitted to use different subtotals and report line items to represent the financial position

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[10] Tom Graves / Tetradian, *And more 'Cynefin-like' cross-maps ('Beyond-Cynefin' series)*, http://weblog.tetradian.com/2010/02/28/and-more-crossmaps/

[11] Amazon.com, Jane Gleeson-White, *Double Entry: How the Merchants of Venice Created Modern Finance*, https://www.amazon.com/gp/product/B007Q6XKA8/

[12] Mathematics Magazine, David Ellerman, *The Mathematics of Double Entry Bookkeeping*, https://ellerman.org/wp-content/uploads/2012/12/DEB-Math-Mag.CV_.pdf

[13] Wikipedia, *Generally Accepted Accounting Principles (United States)*, https://en.wikipedia.org/wiki/Generally_Accepted_Accounting_Principles_(United_States)

[14] Wikipedia, International Financial Reporting Standards, https://en.wikipedia.org/wiki/International_Financial_Reporting_Standards

[15] Charles Hoffman, CPA, *Comparison of Elements of Financial Statement*, http://xbrlsite.azurewebsites.net/2020/master/ElementsOfFinancialStatements.pdf

[16] Wikipedia, *Accounting Equation*, https://en.wikipedia.org/wiki/Accounting_equation

[17] FASB, Statement of Financial Accounting Concepts No. 8, December 2021, Conceptual Framework for Financial Reporting, Chapter 4, *Elements of Financial Statements*, https://fasb.org/Page/document?pdf=Concepts_Statement_8-Chapter_4-Elements.pdf

[18] IFRS Foundation, Conceptual Framework, *Chapter 4 Elements of Financial Statements*, PDF page 25, https://www.ifrs.org/content/dam/ifrs/publications/pdf-standards/english/2021/issued/part-a/conceptual-framework-for-financial-reporting.pdf

and financial performance of that economic entity. This flexibility is intentional, by design, encouraged for specific reasons; and must be considered when creating software applications.

Triple-entry accounting[19] takes double-entry accounting to an entirely new level. Double-entry accounting and triple-entry accounting work together to create an even stronger system. Combined, double- and triple-entry accounting creates bullet proof accounting systems for aggressive uses and users.

It is worth mentioning that some point out that "triple-entry accounting" is something different than how blockchain enthusiasts use the term[20]. What we mean is that there are considerable benefits in writing transaction information into an immutable ledger on a blockchain.

Key 6: Control of Report Model Modifications to Maintain High Report Quality

Financial reporting using both/either US GAAP and IFRS encourages comparability with consistency. What this means is that financial statements are not, should not, and need not be forms. Rather, within the boundaries of these, and other similar, financial reporting schemes; flexibility is provided to economic entities to create their financial reports to effectively describe their economic entities including important unique aspects of the economic entities. As such, reporting economic entities are permitted to modify their report models within permitted boundaries. As such, software applications that enable the creation of such financial reports must control the software users to help keep those software users within these permitted boundaries.

Accounting, like manufacturing, is a process. Accounting processes can benefit from Lean Six Sigma[21] techniques and practices to manage report quality. Financial reports must be accurate, complete, consistent, and the integrity should be intact. If they have those characteristics, they are deemed to be of high quality; true and fair representations. Reporting entities need to minimize any risk of noncompliance with rules and regulations.

Control is provided using the machine-readable accounting and reporting rules described previously in Key 1.

Rules are used to articulate allowed variability and "channel" creators of financial reports in the right direction and therefore control variability, keeping the variability within standard limits.

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[19] Ian Grigg, *Triple-entry Accounting*, https://www.researchgate.net/publication/308640258_Triple_Entry_Accounting

[20] Forbes, *Triple-Entry Accounting And Blockchain: A Common Misconception*, https://www.forbes.com/sites/forbesfinancecouncil/2017/11/28/triple-entry-accounting-and-blockchain-a-common-misconception/?sh=418e2bb3190f

[21] Lean Six Sigma, http://www.xbrlsite.com/mastering/Part01_Chapter02.K_LeanSixSigma.pdf

That keeps quality where it needs to be. Rules enable things like preventing a user from using a concept meant to represent one thing from unintentionally being used to represent something different.

Further, the discipline of describing something in a form a computer algorithm can understand also assists you in understanding the world better; weeding out flaws in your understanding, myths, and misconceptions about accounting and reporting standards. This helps accountants be better accountants.

Key 7: Tamper Proof Audit Trail

Digital financial reporting will involve thousands of machine-readable rules, machine-readable report models and reports, provided by tens of thousands of economic entities, thousands of auditors, tens of thousands of analysts and investors; you get the point.

How can you be sure rules, reports, and other technical artifacts have not been tampered with? How do you know an inadvertent mistake, or an intentional manipulation has not been induced into the system? How can you be sure that software is working correctly and giving you the right answers such that you can rely on automated processes provided by the software?

All of these issues can be effectively handled using immutable digital distributed ledger technologies such as blockchain. Writing information into an immutable digital public ledger offers significant advantages.

Financial reports can be created at different levels, a spectrum of quality and reliability and machine readability, these levels are explained in the document *Financial Report Levels*[22]. Each level builds on the preceding level:

- Level 0 – Provided physically, such as on printed paper, not machine readable
- Level 1 – Provided digitally, but are really "e-paper"; PDF, HTML, Word, etc.
- Level 2 – Structured for meaning, as contrast to structure for presentation
- Level 3 – Structured for meaning using global standard
- Level 4 – Provide a common dictionary
- Level 5 – Provide a complete set of rules
- Level 6 – Provide report level trust related to where complete set of rules came from and assurances that the rules have not been tampered with
- Level 7 – Provide transaction level trust related to rules and transaction information

[22] Auditchain, *Financial Report Levels*, http://accounting.auditchain.finance/library/FinancialReportLevels.pdf

Integrity Level	Machine-Readable	Machine-Understandable (Structured for meaning)	Standardized Syntax	Controlled Vocabulary (Dictionary of Terms)	Standard Report Metamodel (Report logic)	Complete Set of Associations	Complete Set of Rules	Complete Set of Type-subtype Associations	Complete Set of Consistency Cross Checks	Complete Disclosure Mechanics and Reporting Checklist	Merkle Tree of Report Model and Report	Merkle Tree of Report Model, Report, and Transactions
Level 0 (Provide physically)	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Level 1 (Provide digitally)	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Level 2 (Structure for meaning)	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Level 3 (Standard structure)	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗
Level 4 (Provide common dictionary)	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
Level 5 (Complete set of rules)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
Level 6 (Trust report logic)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
Level 7 (Trust transaction provenance)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Only reports at Levels 5 and above can be proven to actually work effectively. Using the good practices (see Key 4) provided by the *Seattle Method*[23], controlled processes (see Key 6) can be created that effectively and provably work. Financial report Level 6 adds increased trust that digital artifacts have not been tampered with and a complete audit trail can be provided and dependability of the digital artifacts. Level 7 applies similar techniques at the accounting systems transaction level.

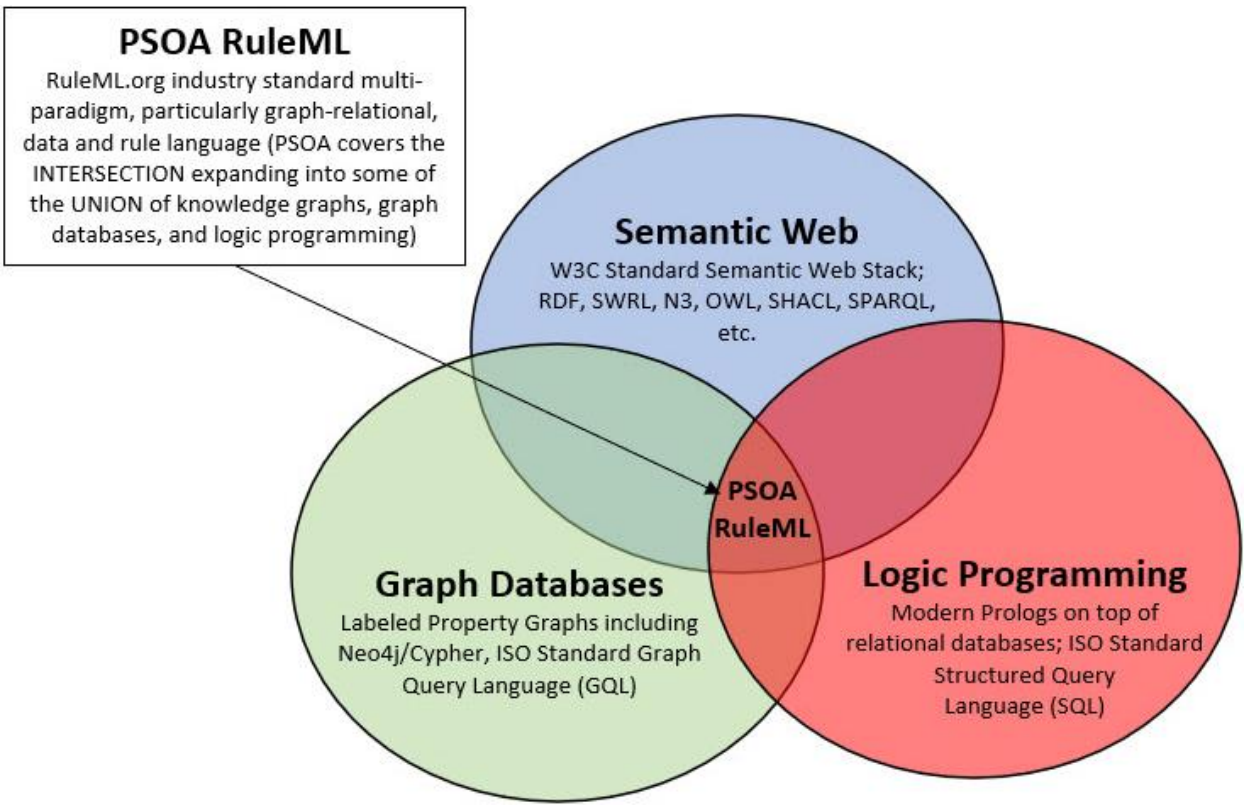
Key 8: Standards Convertible into Multiple Technology Stacks

Standards are necessary for effective digital financial reporting at a global scale. The Extensible Business Reporting Language, XBRL[24], is the de facto standard for digital financial reporting and business reporting with over 180 XBRL projects[25] in 60 different countries.

Standard methods for implementing XBRL have also emerged including the ISO Data Point Model[26] (DPM), Standard Business Reporting[27] (SBR), OMG's Standard Business Report Model[28] (SBRM), European Single Electronic Format[29] (ESEF), and the Seattle Method[30]. There are other approaches to representing XBRL-based digital financial reports.

But enterprises have different preferences for technology stacks that they use to implement technologies within their individual organizations. The industry standards group RuleML[31] points out that there tends to be three primary problem solving logic implementation approaches:

[23] Charles Hoffman, CPA, *Seattle Method*, http://xbrlsite.com/seattlemethod/SeattleMethod.pdf
[24] XBRL International, https://www.xbrl.org/
[25] XBRL International, *XBRL Project Directory*, https://www.xbrl.org/the-standard/why/xbrl-project-directory/
[26] ISO, *ISO Datapoint Methodology*, https://www.iso.org/standard/80873.html
[27] Wikipedia, Standard Business Reporting, https://en.wikipedia.org/wiki/Standard_Business_Reporting
[28] OMG, *Standard Business Report Model* (SBRM), https://www.omg.org/intro/SBRM.pdf
[29] ESMA, European Single Electronic Format, https://www.esma.europa.eu/policy-activities/corporate-disclosure/european-single-electronic-format
[30] Charles Hoffman, CPA, Seattle Method, http://xbrlsite.com/seattlemethod/
[31] RuleML.org, *Graph-Relational Data, Ontologies, and Rules*, http://wiki.ruleml.org/index.php/Graph-Relational_Data,_Ontologies,_and_Rules



RuleML also offers up a very safe "sweet spot"[32] which is a where each of the three primary problem solving logic approaches can be bi-directionally transferred between implementation technical syntaxes. DATALOG[33] seems to be the safest logic processor.

Key 9: Nothing is a "Black Box"

Accounting is about, well, about accounting for things. As such, any accounting or reporting system must be able to explain and justify everything, every detail. Transparency into how conclusions are reached, what rules where used, lines of reasoning, origin of facts and rules used to reach conclusions, and information about the problem-solving method used for any logical deduction or derivation are non-negotiable; they must be provided to creators of information, consumers of information, and all intermediaries involved in the process.

Explainable artificial intelligence[34] (XAI) that is rules base is the tool of choice.

[32] RuleML.org, PSOA RuleML, http://wiki.ruleml.org/index.php/PSOA_RuleML
[33] Wikipedia, Datalog, https://en.wikipedia.org/wiki/Datalog
[34] ACCA, *Explainable AI: Putting the user at the core*, https://www.accaglobal.com/uk/en/professional-insights/technology/Explainable_AI.html

Key 10: High Level Logical Meta Model

In order to achieve several of the other keys, a high-level meta model of a business report is necessary, such as the OMG Standard Business Report Model[35] (SBRM) or the *Logical Theory Describing Financial Report*[36]. The high level logical meta model serves as the consistent model (meta model) that any report model will fit into. The high level meta model also enables the creation of an abstraction that enables the technical syntax, which is hard to understand, can disappear into the background; business users making use of software would deal at the logic level only, never exposed to technical details.

[35] OMG, Standard Business Report Model (SBRM), https://www.omg.org/intro/SBRM.pdf
[36] Charles Hoffman, CPA, *Logical Theory Describing Financial Report*, http://xbrlsite.com/seattlemethod/LogicalTheoryDescribingFinancialReport_Terse.pdf