Chain of Capabilities Necessary to Automate Accounting Processes

By Charles Hoffman, CPA (Charles.Hoffman@me.com)

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"If I had asked people what they wanted, they would have said faster horses." Henry Ford[1]

Executive summary:

- In order to effectively automate accounting processes a chain of capabilities must be perfected.
- Today, no one software vendor has all the product or products that are necessary to enable accounting process automation. But by combining the functionality of software vendors you can get further.
- By mastering every link in the long and sometimes complex chain of capabilities necessary to automate accounting, reporting, auditing, and analysis processes and actually get those processes to work effectively; you will enable your organization to leverage useful technologies and become more effective and more efficient.

[1] Good Reads, https://www.goodreads.com/quotes/15297-if-i-had-asked-people-what-they-wanted-they-would

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In order to effectively automate accounting processes a chain of capabilities must be perfected. Mastery of every link in that long and sometimes complex chain of capabilities is necessary to effectively automate accounting processes. This document explains many of the capabilities that have proven to be necessary to verify that an XBRL-based financial report has been created correctly. Given that financial reports will likely be one part of the accounting, reporting, audit, and analysis process such reports offer clues as to the precise list of capabilities that must be mastered. These techniques used for financial reports can also be used for other parts of accounting, reporting, auditing, and analysis processes and tasks.

Note that using XBRL anticipates the use of XBRL's extensibility. If XBRL's extensibility is not used then leveraging XBRL is trivial. But as the document *Leveraging XBRL Extensibility Effectively*[2] points out, if you do choose to leverage XBRL's extensibility features you have responsibilities to manage extensions.

The document *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*[3] explains why an XBRL-based report must be validated an how to do that. Today I am not aware of one software vendor that provides a complete end-to-end chain of capabilities that would be effective and that would assure that a financial report adheres to basic structural, mechanical, mathematical, and logical rules for creating such reports. This document further builds on that first document to help the reader understand how to eliminate defects and automate processes and tasks.

Overview of Basic Capabilities to Verify Reports

The following is a summary of the basic tasks that are necessary to verify that an XBRL-based financial report has been created correctly:

- **XBRL technical syntax consistency**: XBRL instance created MUST be checked for and proved to be consistent with the XBRL International consistency suite for XBRL 2.1, XBRL Dimensions 1.0, and XBRL Formula 1.0.
- **Model structure consistency**: The XBRL presentation relations MUST be checked for and proved to be consistent with the allowed relationships between the following report elements: Networks, Tables, Axis, Members, Line Items, Concepts, and Abstracts. See the table below.

[2] *Leveraging XBRL Extensibility Effectively*, http://xbrlsite.azurewebsites.net/2018/Library/LeveragingXBRLExtensibilityEffectively.pdf

[3] *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*, http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf

- **Reporting styles**: The reporting style used MUST be consistent with reporting rules of the reporting scheme used to create the report, generally US GAAP or IFRS for financial reports.
- **Continuity cross-checks**: The XBRL instance MUST be checked for and proved consistent with business rules that enforce relations between reported line items per the reporting style used.
- **Types**: The XBRL instance MUST be checked for and proved consistent with specified detailed line item relations of the reporting scheme and reporting style used.
- **Reporting checklist**: The XBRL instance MUST be checked for and proven consistent with disclosure rules of the reporting scheme used.
- **Disclosure mechanics**: The XBRL instance and the XBRL taxonomy MUST be checked for an proven consistent in terms of mathematical relations (roll ups, roll forwards, member aggregations which is a form of roll up represented via XBRL Dimensions); in terms of structural relations (i.e. the integrity of report fragments MUST be consistent within each fragment and between fragments); in terms of logical relations; in terms of accounting relations; in terms of the disclosure rules of the reporting scheme used.
- **Manual review of non-automatable tasks**: All review tasks that cannot be automated for one reason or another such as lack of machine-readable verification rules or an inability of software to tackle specific tasks must be verified using manual processes.

In the next sections I will explain each of these categories to help the reader understand exactly what sorts of verification task is preformed and why the task is necessary.

XBRL technical syntax consistency

XBRL International provides an XBRL conformance suite which is used to test the XBRL technical syntax of an XBRL-based digital financial report for consistency with the XBRL technical specifications. The conformance suite has 578 test that relate to the base XBRL 2.1 specification[4] and 994 tests relating to the XBRL Dimensions 1.0 technical specification[5]. These validation tasks are uninteresting to professional accountants; the technical syntax just needs to be correct and managed by the software application.

Today, XBRL-based public company financial reports which are submitted to the SEC are 99.99% consistent with the XBRL 2.1 and XBRL Dimensions 1.0 technical syntax.

[4] XBRL International, XBRL 2.1 base technical specification conformance suite, https://specifications.xbrl.org/work-product-index-group-base-spec-base-spec.html
[5] XBRL International, XBRL Dimensions 1.0 technical specification conformance suite, https://specifications.xbrl.org/work-product-index-group-dimensions-dimensions.html

Included in the XBRL technical syntax validation is the validation of XBRL calculations or **roll up** computations. For example, below you see the roll up of the pieces that make up of total inventory:

Component: (Network and Table)	
Network	5040 - Disclosure - **Inventory Components**
Table	Inventory Components [Table]

Reporting Entity [Axis]	0000000001 http://www.sec.gov/CIK	
Legal Entity [Axis]	Consolidated Entity [Domain]	
	Period [Axis]	
Inventory Components [Line Items]	2016-12-31	2015-12-31
Inventory, Net [Roll Up]		
Finished Goods	1,000,000	1,000,000
Work in progress	1,000,000	1,000,000
Raw materials	1,000,000	1,000,000
Other	1,000,000	1,000,000
Total inventories, net	4,000,000	4,000,000

XBRL calculations can be used to represent and verify these roll up type mathematical computations. Financial reports generally contain numerous roll up type computations. It should never be the case that such a roll up computation is undocumented within an XBRL-based financial report and the information I the report be consistent with the XBRL calculation representation of such roll ups. Creators of XBRL-based financial reports should never be allowed to leave these roll up mathematical relations undocumented. If they are documented, then XBRL processing can verify the consistency of information in the XBRL-based financial report with these roll ups documented by XBRL calculation relations.

XBRL calculation relations cannot be used to document all mathematical computations within an XBRL-based report. However, XBRL Formula can generally be used to document all such relations. As such, these other types of mathematical relations such as roll forwards or member aggregations (which is a type of roll forward) are considered in the disclosure mechanics section.

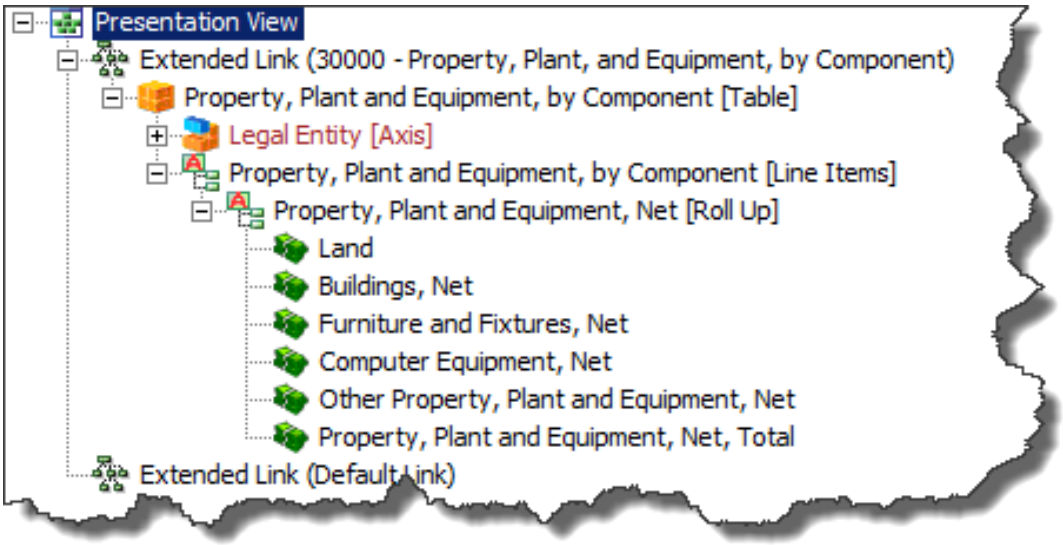
Model structure consistency

Model structure validation tests the consistency of relationships between categories of report elements within XBRL presentation relations. These presentation relations are not covered by XBRL validation because the relations are not specified by the XBRL technical syntax[6].

[6] A really good question would be, "Could these relations be verified by XBRL technical syntax? The answer is yes, they could.

While XBRL calculation relations are checked as part of the base XBRL 2.1 technical syntax validation and XBRL definition relations are checked as part of the XBRL 2.1 technical syntax validation plus the additional XBRL Dimensions 1.0 technical syntax validation; the allowed and disallowed relationships between the different categories of report elements in the XBRL presentation relations are not covered by the XBRL technical specification. As such, supplemental automated validation was created to satisfy this need.

What is meant by the model structure relations are the relations between XBRL networks, hypercubes, dimensions, members, primary items, concrete concepts, and abstract concepts. For example, here is an example of XBRL presentation relations:



A pathological example will help you see my point. The following is completely valid per the XBRL technical specification for XBRL presentation relations:

You should have two questions about the above pathological representation. The first question is, "*What does the representation mean?*" The second question is, "*Why would something like that representation be allowed per the XBRL technical specification?*"

While most XBRL presentation relations problems are not as bad as the pathological example provided above (which was provided to make a point); problems do exist today.

The model structure of an XBRL-based public company financial report is generally not disputed and today over 99.9% of all XBRL-based public company financial reports submitted to the SEC are consistent with supplemental rules I specified[7] in machine-readable form so that testing the relations can be automated. Very few would dispute any of the relations particularly since 99.9% of public company XBRL-based financial reports submitted to the SEC are consistent with the rules I specified.

The following matrix shows the valid and invalid relations between the pieces that make up the XBRL presentation relations model structure which include **Network**, **Table** (i.e. Hypercube), **Axis** (i.e. Dimensions), **Member**, **Line Items** (i.e. Primary Items), **Abstract**, and **Concept** report elements: (RED is enforced by the XBRL technical specification, ORANGE is not allowed, YELLOW is not advised, and GREEN is allowed)

[7] Model structure rules represented within XBRL definition relations, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/model-structure/ModelStructure-rules-us-gaap-def.xml

		Parent						
		Network	Table	Axis	Member	LineItems	Abstract	Concept
Child	Network	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL
	Table	OK	Disallowed	Disallowed	Disallowed	Disallowed	OK	Disallowed
	Axis	Disallowed	OK	Disallowed	Disallowed	Disallowed	Disallowed	Disallowed
	Member	Disallowed	Disallowed	OK	OK	Disallowed	Disallowed	Disallowed
	LineItems	Disallowed	OK	Disallowed	Disallowed	Disallowed	Disallowed	Disallowed
	Abstract	OK	Disallowed	Disallowed	Disallowed	OK	OK	OK
	Concept	Disallowed	Disallowed	Disallowed	Disallowed	OK	OK	Not advised

A good question might be, "*Why doesn't the SEC or FASB or even XBRL International specify these allowed and disallowed relationships?*"

Reporting styles

A reporting style is the notion that there are patterns to how financial reports are created. Saying this in another way, the organization of reported information is not random. Empirical evidence[8] from examining about 6,000 public company financial reports prepared using US GAAP[9] and about 400 foreign issuers that create their reports using IFRS[10] reveals that about 80% of all reports follow less than 20 different reporting styles. The total number of reporting styles is as of yet not determined, but the number is finite. Again, the information in these reports is not random.

Reporting styles is essentially an organization scheme of the high-level financial statement line items in particular ways. I have called these "fundamental accounting concept relations" in the past. But now I recognize that what these are really continuity cross-checks which I will discuss next.

Continuity cross-checks

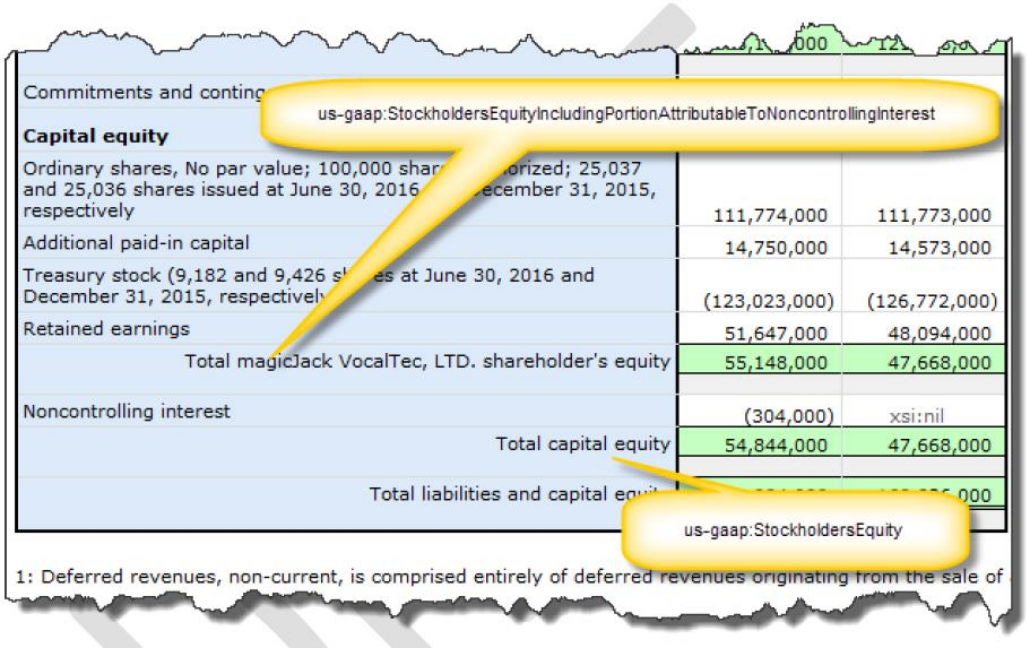
Another common error which exists is in XBRL-based financial reports of public companies is to represent facts that conflict with, contradict, or is illogical relative to other reported facts or are inconsistent with the way other public companies report similar facts. You can think of these relations as **continuity cross-checks**. Again, none of these errors would be caught by XBRL technical syntax, report specific mathematical relations, model structure, or type/class relations validation. All an XBRL processor cares about is whether a roll up does, in fact, roll up; an XBRL processor has no knowledge of the concepts that are participating in the roll up.

[8] Charles Hoffman, *Making the Case for Reporting Styles*, http://xbrlsite.azurewebsites.net/2017/library/MakingTheCaseForReportingStyles.pdf
[9] US GAAP Reporting Styles, http://www.xbrlsite.com/2018/10K/US-GAAP-Reporting-Styles.pdf
[10] IFRS Reporting Styles, http://www.xbrlsite.com/2018/IFRS/IFRS-Reporting-Styles.pdf

A simple example of a fundamental accounting concept relation continuity cross-check is the accounting equation[11]: *Assets = Liabilities and Equity*.

I will provide two examples to help you better understand the essence of these fundamental accounting concept relations continuity cross-checks. I would encourage you to have a look at the many examples[12] which document errors found by the fundamental accounting concept relations continuity cross-checks.

In this first example[13] below, the public company reversed the equity concepts used. The company reversed the concepts used to represent the line items "Equity attributable to parent" and "Equity" (parent + noncontrolling interest):



What happened is that the company reversed the concepts as contrast to the intended meaning of the concepts per the US GAAP XBRL Taxonomy.

In the second example[14], the public company used an after-tax concept "us-gaap:IncomeLossFromContinuingOperations" to represent a before-tax line item. The concept that they should have used is "us-gaap:OperatingIncomeLoss".

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[11] Wikipedia, Accounting Equation, retrieved May 1, 2017, https://en.wikipedia.org/wiki/Accounting_equation
[12] Charles Hoffman, *High Quality Examples of Errors in XBRL-based Financial Reports*, http://xbrl.squarespace.com/journal/2017/4/29/high-quality-examples-of-errors-in-xbrl-based-financial-repo.html
[13] You can observe this in the filing for yourself here, http://www.sec.gov/Archives/edgar/data/1005699/000117891316006153/0001178913-16-006153-index.htm
[14] Which you can find here, http://www.sec.gov/Archives/edgar/data/21510/000002151016000068/0000021510-16-000068-index.htm

Income Statement [Abstract]	Period [Axis] 2016-04-03 - 2016-07-02	2015-10-04 - 2016-07-02	2015-04-05 - 2015-07-04	2014-09-28 - 2015-07-04
Income Statement [Abstract]				
Net sales	218,767,000	608,924,000	188,502,000	592,838,000
Cost of sales	124,208,000	341,868,000	109,720,000	348,433,000
Gross profit	94,559,000	267,056,000	78,782,000	244,405,000
Operating expenses:				
Research and development	21,441,000	61,500,000	21,270,000	61,467,000
Selling, general and administrative	46,256,000	126,970,000	36,154,000	113,777,000
Impairment of investment	0	0	2,017,000	2,017,000
Amortization of intangible assets	574,000	1,975,000	647,000	2,009,000
Total operating expenses	68,271,000	187,481,000	60,088,000	179,270,000
Income from operations	26,288,000	79,575,000	18,694,000	65,135,000
Other income (expense):				
Interest and dividend income	351,000	854,000	183,000	440,000
Interest expense	(63,000)	(108,000)	(4,000)	(29,000)
Other—net	564,000	(1,896,000)	(787,000)	286,000
Total other income (expense), net	852,000	(1,150,000)	(608,000)	697,000
Income before income taxes	27,140,000	78,425,000	18,086,000	65,832,000
Provision for income taxes	8,490,000	21,708,000	4,822,000	16,725,000
Net income	18,650,000	56,717,000	13,264,000	49,107,000

While many of the fundamental accounting concept relations continuity cross checks can be understood by simply looking at one XBRL-based financial report; other errors are better understood when you examine many and even the entire set of about 6,000 such reports and compare/contract how different companies handle exactly the same reporting situation. That is exactly how I figured out that these relations where so consistent[15]. Further, additional insight can be realized if you compare information across the set of reports submitted each period for a public company.

Existing public company filings provide evidence of both the correct way to represent fundamental accounting concept relations and the incorrect way to represent such information.

Types

Type or class relations[16] validation has to do with the proper use of a concept relative to another concept. Type or class relations are similar and related to consistency cross-checks; however they generally relate to the use of lower-level line items rather than higher-level line items of a financial report.

[15] *Quarterly XBRL-based Public Company Financial Report Quality Measurement (September 2018)*, http://xbrl.squarespace.com/journal/2018/9/29/quarterly-xbrl-based-public-company-financial-report-quality.html

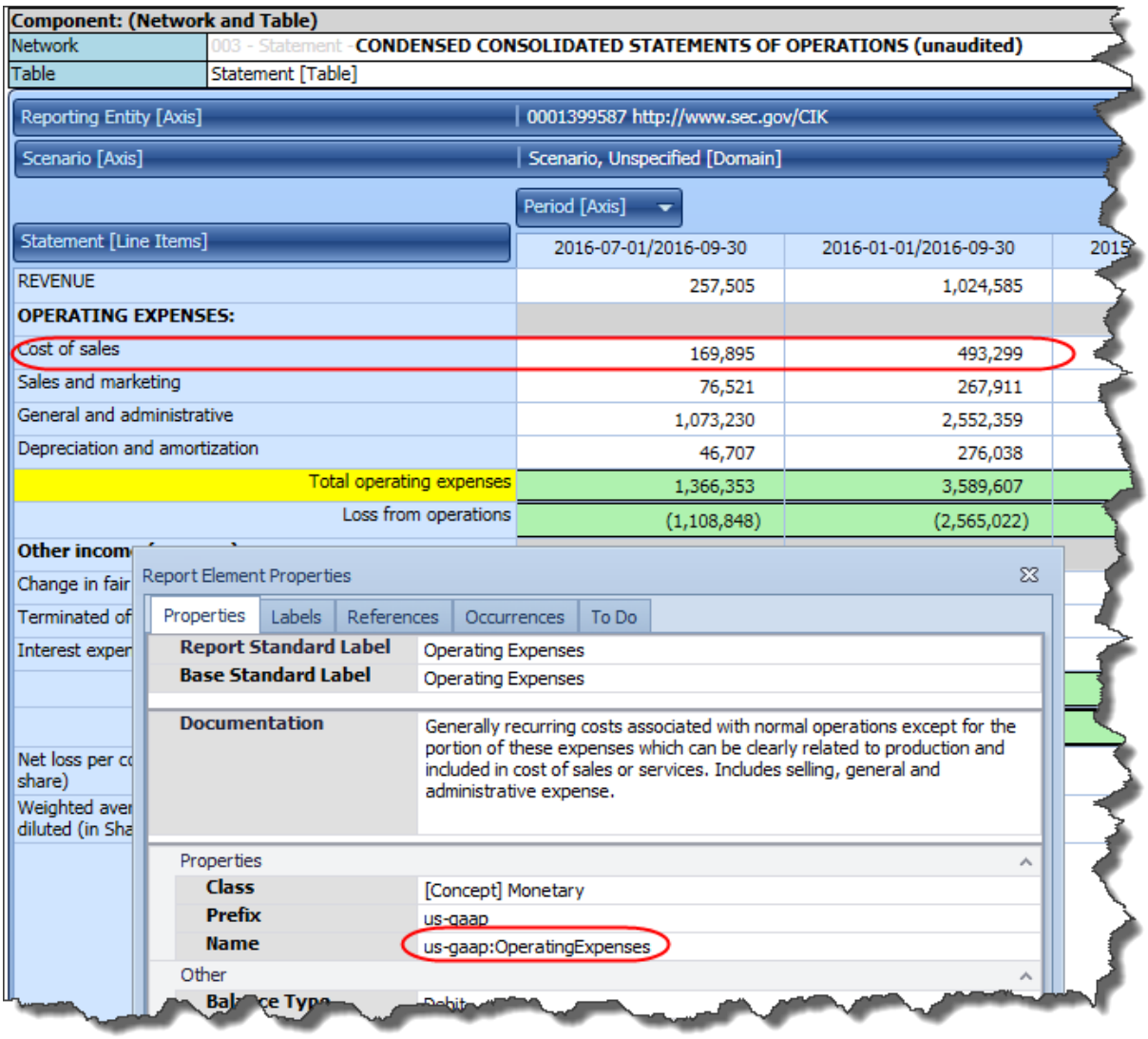
[16] Mereology is the theory of parthood relations: of the relations of part to whole and the relations of part to part within a whole. Stanford Encyclopedia of Philosophy, https://plato.stanford.edu/entries/mereology/

The best way to understand type or class relations is with an example of a common mistake that is made in financial reports when representing information using XBRL.

In this filing[17] as you can see in the graphic below the public company represented the line item labeled “Total operating expenses” using the concept “us-gaap:OperatingExpenses”. That seems like it might be correct, however this is a representation error as you will soon see.

If you note from the income statement, the line item “Cost of Sales”, represented using the concept “us-gaap:CostOfRevenue” which is used to represent *direct operating expenses* is included within the line item represented with the concept “us-gaap:OperatingExpenses” which is used to represent *indirect operating expenses*. What this public company should have done is to use the concept “us-gaap:CostsAndExpenses” which is used to represent a fact which includes *both direct and indirect operating expenses*.

[17] See, http://www.sec.gov/Archives/edgar/data/1399587/000118518516005694/0001185185-16-005694-index.htm



There are other similar types of relations related to the proper use of a concept relative to some other concept within an XBRL-based public company financial report. The tests of type or class relations are represented using XBRL definition relations[18]. I have found that representing both positive relations which indicates what is allowed and specific negative example of common mistakes is the most helpful.

While the layout of the US GAAP XBRL Taxonomy and IFRS XBRL Taxonomy are not particularly beneficial in helping users of those taxonomies identify the allowed and disallowed relations; that does not mean that representing information incorrectly per the logic of US GAAP or IFRS is allowable. It's not.

[18] Type or Class relations represented as XBRL definition relations, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/type-class/TypeOrClassRelations-us-gaap.xsd

Reporting checklist

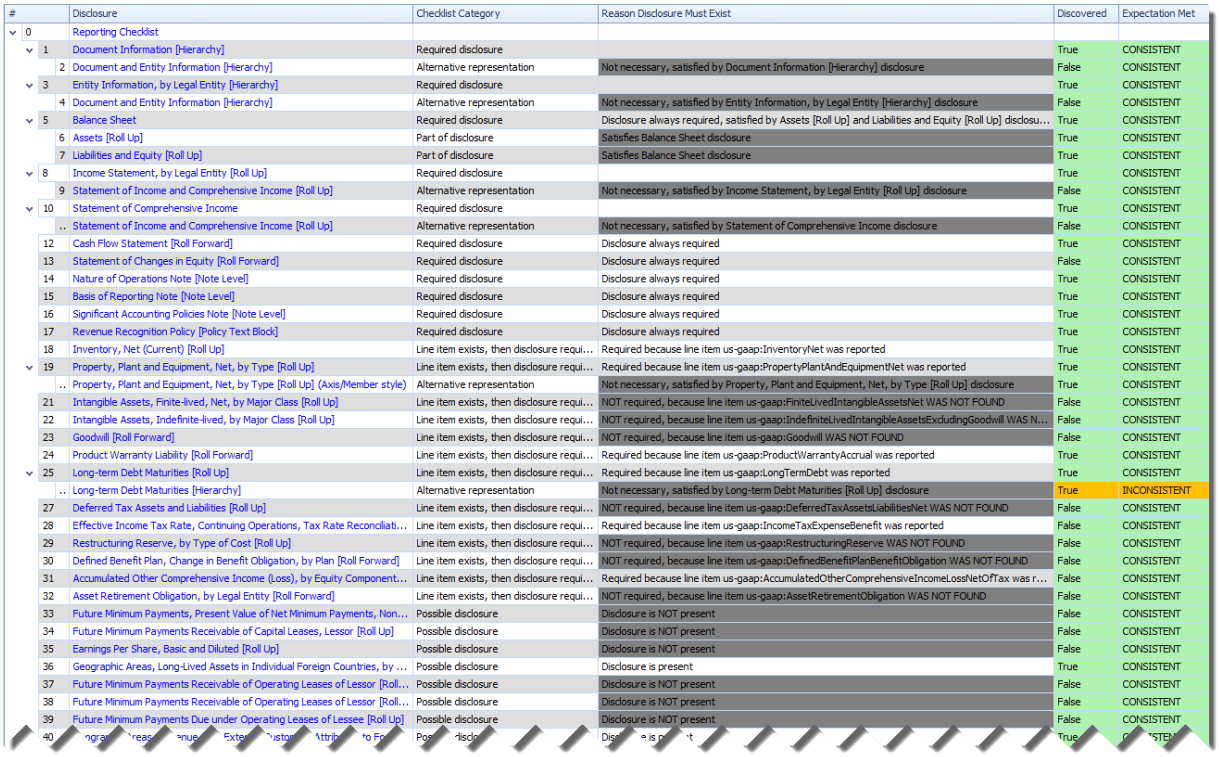
Today, professional accountants use what they commonly refer to as a "disclosure checklist[19]" as a memory jogger during the process of creating a financial report. That reporting checklist outlines statutory and regulatory disclosure rules that indicate what should be included within a financial report. The disclosure checklist or reporting checklist is made up of maybe between 100 to 200 pages, usually in a Word document or PDF which is filled out by an accountant.

What if you can take that memory jogger which is written in a form readably only by humans and transformed it into a form readable by both humans and machine-based processes. What if a human augmented by a tool which could leverage that machine-readable information could work as a team to review a financial report?

Many, but not all, of these disclosure rules can be made machine-readable, leveraging knowledge representation techniques[20] and the structured nature of XBRL. And so with an XBRL-based reporting checklist[21] machine-based processes can take over the routine, repetitive, mechanical tasks of making sure a financial report is created correctly allowing professional accountants to focus on the subjective, non-routine, and other tasks that require professional judgement.

Some disclosures are always required. Other disclosures are required if specific line items are reported. Other disclosures are required only if specific transactions, events, circumstances, or other phenomenon exist for an economic entity. Here is the interface which a business professional would interact with which is generated by the machine-based reporting checklist[22]:

[19] Charles Hoffman, *Automating Accounting and Reporting Checklists*, http://xbrl.squarespace.com/journal/2016/5/5/automating-accounting-and-reporting-checklists.html
[20] Charles Hoffman, *Introduction to Knowledge Engineering for Professional Accountants*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.3_KnowledgeEngineeringBasicsForProfessionalAccountants.pdf
[21] Reporting checklist rules, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/reporting-checklist/ReportingChecklist-us-gaap-strict-rules-def.xml
[22] Reporting checklist validation results for Microsoft, http://xbrlsite.azurewebsites.net/2017/Prototypes/DisclosureMechanicsExample/ReportingChecklistSummary.jpg



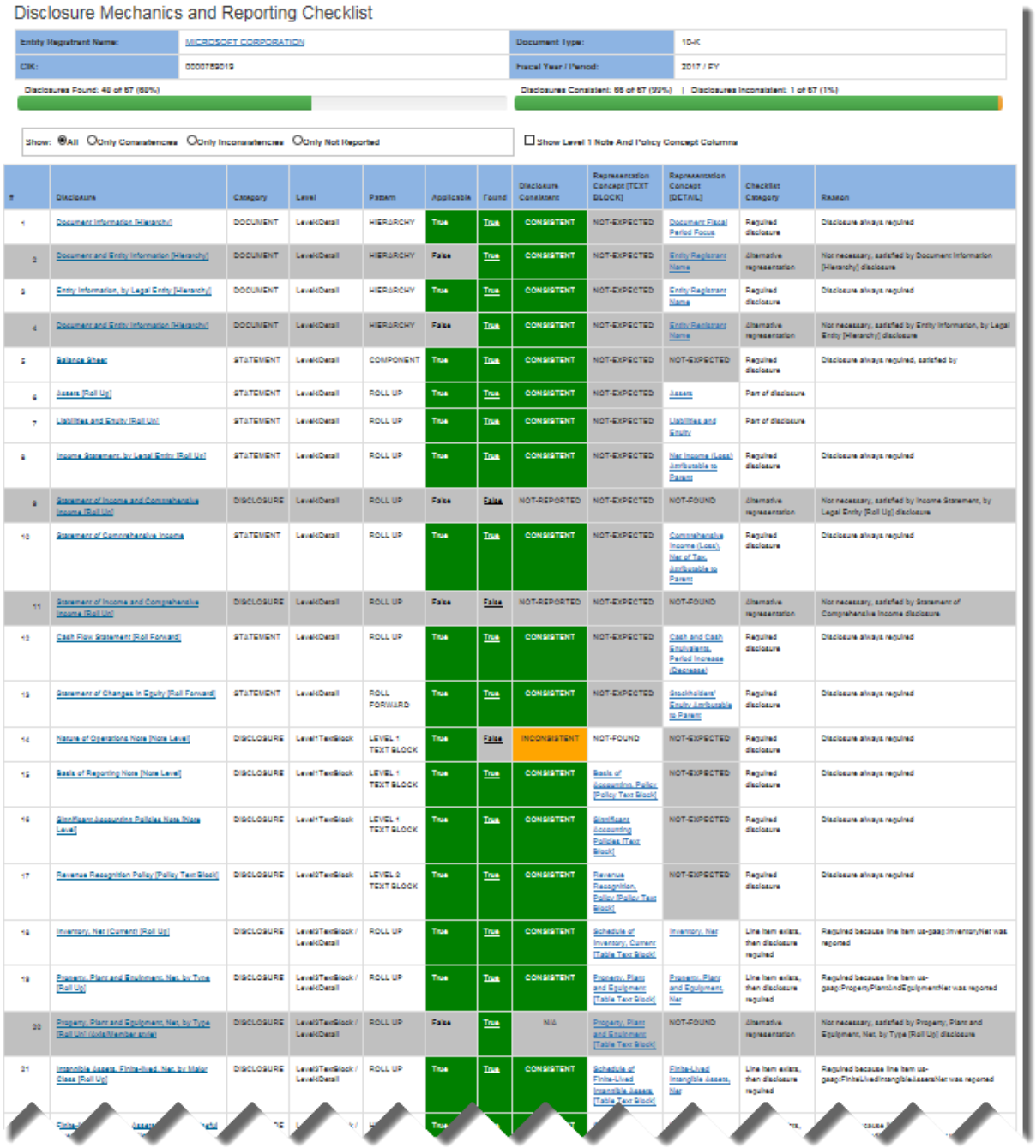
#		Disclosure	Checklist Category	Reason Disclosure Must Exist	Discovered	Expectation Met
0		Reporting Checklist				
1		Document Information [Hierarchy]	Required disclosure		True	CONSISTENT
	2	Document and Entity Information [Hierarchy]	Alternative representation	Not necessary, satisfied by Document Information [Hierarchy] disclosure	False	CONSISTENT
3		Entity Information, by Legal Entity [Hierarchy]	Required disclosure		True	CONSISTENT
	4	Document and Entity Information [Hierarchy]	Alternative representation	Not necessary, satisfied by Entity Information, by Legal Entity [Hierarchy] disclosure	False	CONSISTENT
5		Balance Sheet	Required disclosure	Disclosure always required, satisfied by Assets [Roll Up] and Liabilities and Equity [Roll Up] disclosu...	True	CONSISTENT
	6	Assets [Roll Up]	Part of disclosure	Satisfies Balance Sheet disclosure	True	CONSISTENT
	7	Liabilities and Equity [Roll Up]	Part of disclosure	Satisfies Balance Sheet disclosure	True	CONSISTENT
8		Income Statement, by Legal Entity [Roll Up]	Required disclosure		True	CONSISTENT
	9	Statement of Income and Comprehensive Income [Roll Up]	Alternative representation	Not necessary, satisfied by Income Statement, by Legal Entity [Roll Up] disclosure	False	CONSISTENT
10		Statement of Comprehensive Income	Required disclosure		True	CONSISTENT
	..	Statement of Income and Comprehensive Income [Roll Up]	Alternative representation	Not necessary, satisfied by Statement of Comprehensive Income disclosure	False	CONSISTENT
12		Cash Flow Statement [Roll Forward]	Required disclosure	Disclosure always required	True	CONSISTENT
13		Statement of Changes in Equity [Roll Forward]	Required disclosure	Disclosure always required	False	CONSISTENT
14		Nature of Operations Note [Note Level]	Required disclosure	Disclosure always required	True	CONSISTENT
15		Basis of Reporting Note [Note Level]	Required disclosure	Disclosure always required	True	CONSISTENT
16		Significant Accounting Policies Note [Note Level]	Required disclosure	Disclosure always required	True	CONSISTENT
17		Revenue Recognition Policy [Policy Text Block]	Required disclosure	Disclosure always required	True	CONSISTENT
18		Inventory, Net (Current) [Roll Up]	Line item exists, then disclosure requi...	Required because line item us-gaap:InventoryNet was reported	True	CONSISTENT
19		Property, Plant and Equipment, Net, by Type [Roll Up]	Line item exists, then disclosure requi...	Required because line item us-gaap:PropertyPlantAndEquipmentNet was reported	True	CONSISTENT
	..	Property, Plant and Equipment, Net, by Type [Roll Up] (Axis/Member style)	Alternative representation	Not necessary, satisfied by Property, Plant and Equipment, Net, by Type [Roll Up] disclosure	True	CONSISTENT
21		Intangible Assets, Finite-lived, Net, by Major Class [Roll Up]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:FiniteLivedIntangibleAssetsNet WAS NOT FOUND	False	CONSISTENT
22		Intangible Assets, Indefinite-lived, by Major Class [Roll Up]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:IndefiniteLivedIntangibleAssetsExcludingGoodwill WAS N...	False	CONSISTENT
23		Goodwill [Roll Forward]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:Goodwill WAS NOT FOUND	False	CONSISTENT
24		Product Warranty Liability [Roll Forward]	Line item exists, then disclosure requi...	Required because line item us-gaap:ProductWarrantyAccrual was reported	True	CONSISTENT
25		Long-term Debt Maturities [Roll Up]	Line item exists, then disclosure requi...	Required because line item us-gaap:LongTermDebt was reported	True	CONSISTENT
	..	Long-term Debt Maturities [Hierarchy]	Alternative representation	Not necessary, satisfied by Long-term Debt Maturities [Roll Up] disclosure	True	INCONSISTENT
27		Deferred Tax Assets and Liabilities [Roll Up]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:DeferredTaxAssetsLiabilitiesNet WAS NOT FOUND	False	CONSISTENT
28		Effective Income Tax Rate, Continuing Operations, Tax Rate Reconciliati...	Line item exists, then disclosure requi...	Required because line item us-gaap:IncomeTaxExpenseBenefit was reported	False	CONSISTENT
29		Restructuring Reserve, by Type of Cost [Roll Up]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:RestructuringReserve WAS NOT FOUND	False	CONSISTENT
30		Defined Benefit Plan, Change in Benefit Obligation, by Plan [Roll Forward]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:DefinedBenefitPlanBenefitObligation WAS NOT FOUND	False	CONSISTENT
31		Accumulated Other Comprehensive Income (Loss), by Equity Component...	Line item exists, then disclosure requi...	Required because line item us-gaap:AccumulatedOtherComprehensiveIncomeLossNetOfTax was r...	False	CONSISTENT
32		Asset Retirement Obligation, by Legal Entity [Roll Forward]	Line item exists, then disclosure requi...	NOT required, because line item us-gaap:AssetRetirementObligation WAS NOT FOUND	False	CONSISTENT
33		Future Minimum Payments, Present Value of Net Minimum Payments, Non...	Possible disclosure	Disclosure is NOT present	False	CONSISTENT
34		Future Minimum Payments Receivable of Capital Leases, Lessor [Roll Up]	Possible disclosure	Disclosure is NOT present	False	CONSISTENT
35		Earnings Per Share, Basic and Diluted [Roll Up]	Possible disclosure	Disclosure is NOT present	False	CONSISTENT
36		Geographic Areas, Long-Lived Assets in Individual Foreign Countries, by ...	Possible disclosure	Disclosure is present	True	CONSISTENT
37		Future Minimum Payments Receivable of Operating Leases of Lessor [Roll...	Possible disclosure	Disclosure is NOT present	False	CONSISTENT
38		Future Minimum Payments Receivable of Operating Leases of Lessor [Roll...	Possible disclosure	Disclosure is NOT present	False	CONSISTENT
39		Future Minimum Payments Due under Operating Leases of Lessee [Roll Up]	Possible disclosure	Disclosure is NOT present	False	CONSISTENT
40		[illegible]	[illegible]	[illegible]	True	[illegible]

Areas of the report that might need further investigation by a human are highlighted in the color orange in the example. You can think of this as management by exception.

Again, 100% of all fragments of a report can be verified using a combination of machine-based and human-based processes. And again, machine-based processes are often preferred due to higher reliability and lower cost.

Below is a combined reporting checklist and disclosure mechanics review and verification tool which is made available by XBRL Cloud[23] as a commercial product offering. (Note the footnote below which provides a link to a working version of this tool. Click on the links on the HTML page.)

[23] XBRL Cloud Disclosure Mechanics and Reporting Checklist review tool, http://xbrlsite.azurewebsites.net/2017/Prototypes/DisclosureMechanicsExample/DisclosureMechanicsAndReportingChecklist.html



Disclosure Mechanics and Reporting Checklist

Entity Registrant Name:	MICROSOFT CORPORATION	Document Type:	10-K
CIK:	0000789019	Fiscal Year / Period:	2017 / FY

Disclosures Found: 49 of 87 (56%)

Disclosures Consistent: 95 of 87 (99%) | Disclosures Inconsistent: 1 of 87 (1%)

Show: ◉All ○Only Consistencies ○Only Inconsistencies ○Only Not Reported ☐Show Level 1 Note And Policy Concept Columns

#	Disclosure	Category	Level	Param	Applicable	Found	Disclosure Consistency	Representation Concept [TEXT BLOCK]	Representation Concept [DETAIL]	Checklist Category	Reason
1	Document Information [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	True	True	CONSISTENT	NOT-EXPECTED	Document Fiscal Period Focus	Required disclosure	Disclosure always required
2	Document and Entity Information [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	False	True	CONSISTENT	NOT-EXPECTED	Entity Registrant Name	Alternative representation	Not necessary; satisfied by Document Information [Hierarchy] disclosure
3	Entity Information, by Legal Entity [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	True	True	CONSISTENT	NOT-EXPECTED	Entity Registrant Name	Required disclosure	Disclosure always required
4	Document and Entity Information [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	False	True	CONSISTENT	NOT-EXPECTED	Entity Registrant Name	Alternative representation	Not necessary; satisfied by Entity Information, by Legal Entity [Hierarchy] disclosure
5	Balance Sheet	STATEMENT	Level4Detail	COMPONENT	True	True	CONSISTENT	NOT-EXPECTED	NOT-EXPECTED	Required disclosure	Disclosure always required; satisfied by
6	Assets [Roll Up]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Assets	Part of disclosure	
7	Liabilities and Equity [Roll Up]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Liabilities and Equity	Part of disclosure	
8	Income Statement, by Legal Entity [Roll Up]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Net Income (Loss) Attributable to Parent	Required disclosure	Disclosure always required
9	Statement of Income and Comprehensive Income [Roll Up]	DISCLOSURE	Level4Detail	ROLL UP	False	False	NOT-REPORTED	NOT-EXPECTED	NOT-FOUND	Alternative representation	Not necessary; satisfied by Income Statement, by Legal Entity [Roll Up] disclosure
10	Statement of Comprehensive Income	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Comprehensive Income (Loss), Net of Tax, Attributable to Parent	Required disclosure	Disclosure always required
11	Statement of Income and Comprehensive Income [Roll Up]	DISCLOSURE	Level4Detail	ROLL UP	False	False	NOT-REPORTED	NOT-EXPECTED	NOT-FOUND	Alternative representation	Not necessary; satisfied by Statement of Comprehensive Income disclosure
12	Cash Flow Statement [Roll Forward]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Cash and Cash Equivalents, Period Increase (Decrease)	Required disclosure	Disclosure always required
13	Statement of Changes in Equity [Roll Forward]	STATEMENT	Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Stockholders' Equity Attributable to Parent	Required disclosure	Disclosure always required
14	Nature of Operations Note [Note Level]	DISCLOSURE	Level1TextBlock	LEVEL 1 TEXT BLOCK	True	False	INCONSISTENT	NOT-FOUND	NOT-EXPECTED	Required disclosure	Disclosure always required
15	Basis of Reporting Note [Note Level]	DISCLOSURE	Level1TextBlock	LEVEL 1 TEXT BLOCK	True	True	CONSISTENT	Basis of Accounting, Policy [Policy Text Block]	NOT-EXPECTED	Required disclosure	Disclosure always required
16	Significant Accounting Policies Note [Note Level]	DISCLOSURE	Level1TextBlock	LEVEL 1 TEXT BLOCK	True	True	CONSISTENT	Significant Accounting Policies [Text Block]	NOT-EXPECTED	Required disclosure	Disclosure always required
17	Revenue Recognition Policy [Policy Text Block]	DISCLOSURE	Level2TextBlock	LEVEL 2 TEXT BLOCK	True	True	CONSISTENT	Revenue Recognition, Policy [Policy Text Block]	NOT-EXPECTED	Required disclosure	Disclosure always required
18	Inventory, Net (Current) [Roll Up]	DISCLOSURE	Level3TextBlock / Level4Detail	ROLL UP	True	True	CONSISTENT	Schedule of Inventory, Current [Table Text Block]	Inventory, Net	Line item exists, then disclosure required	Required because line item us-gaap:InventoryNet was reported
19	Property, Plant and Equipment, Net, by Type [Roll Up]	DISCLOSURE	Level3TextBlock / Level4Detail	ROLL UP	True	True	CONSISTENT	Property, Plant and Equipment [Table Text Block]	Property, Plant and Equipment, Net	Line item exists, then disclosure required	Required because line item us-gaap:PropertyPlantAndEquipmentNet was reported
20	Property, Plant and Equipment, Net, by Type [Roll Up] (axis/Member axis)	DISCLOSURE	Level3TextBlock / Level4Detail	ROLL UP	False	True	N/A	Property, Plant and Equipment [Table Text Block]	NOT-FOUND	Alternative representation	Not necessary; satisfied by Property, Plant and Equipment, Net, by Type [Roll Up] disclosure
21	Intangible Assets, Finite-lived, Net, by Major Class [Roll Up]	DISCLOSURE	Level3TextBlock / Level4Detail	ROLL UP	True	True	CONSISTENT	Schedule of Finite-Lived Intangible Assets [Table Text Block]	Finite-Lived Intangible Assets, Net	Line item exists, then disclosure required	Required because line item us-gaap:FiniteLivedIntangibleAssetsNet was reported

Essentially, statutory and regulatory rules must be met when creating a financial report. Different reporting schemes have different requirements, but each has information that is always required, required if another piece of information is reported, required if another disclosure is reported, or some other relation between reported facts within a report. Many of these statutory and regulatory rules, but not all, can be checked using automated processes.

Disclosure Mechanics

A financial report is not one big thing. A financial report is really a combination of lots of smaller fragments which work together and make up the one complete report. These fragments can be related to each other logically, structurally, mechanically, and mathematically.

Patterns exist within the fragments of an XBRL-based financial report. Disclosures have patterns. The disclosure mechanics rules document those patterns[24]. Disclosure mechanics rules document the logical, mechanical, and mathematical relations within a specific disclosure in machine-readable form which enables automated machine-based processes to leverage that knowledge.

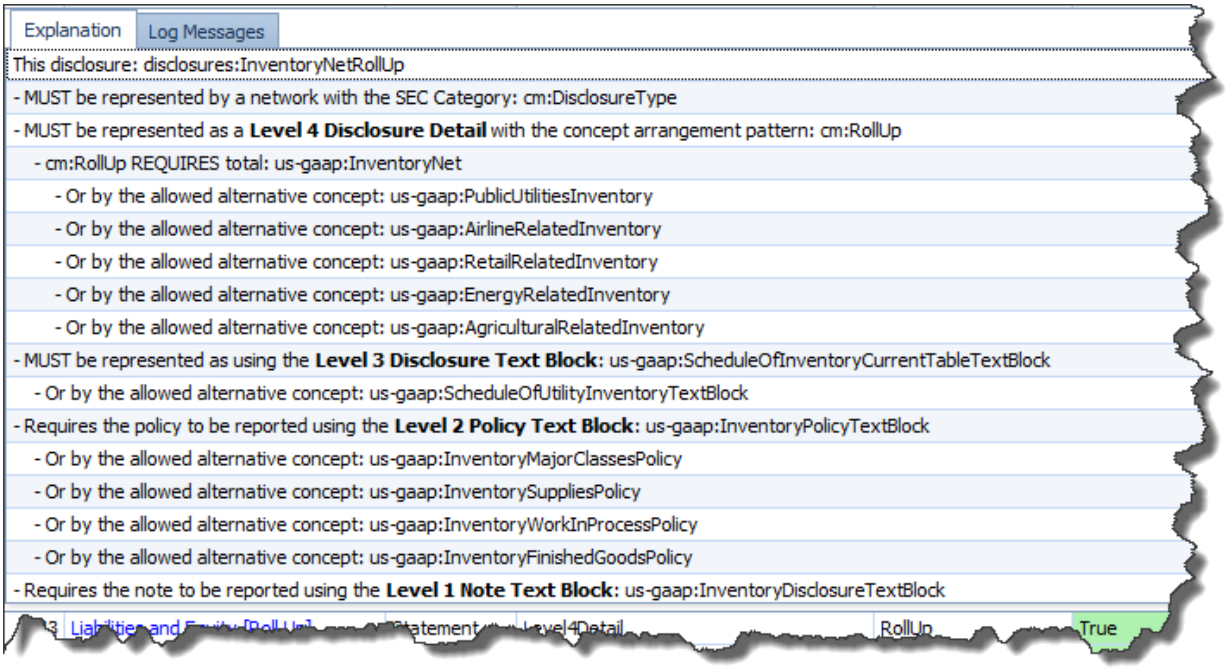
For example, the disclosure of the Level 4 Disclosure detail of inventory components is *always* a Roll Up, the total concept of that roll up is *always* the concept "us-gaap:InventoryNet", the Level 3 Disclosure Text Block which must be reported if that disclosure exists is *always* "us-gaap:ScheduleOfInventoryCurrentTableTextBlock", the Level 1 Note Text Block is *usually* the concept "us-gaap:InventoryDisclosureTextBlock" unless the reporting entity organized their notes with some different presentation, and the related Level 2 Policy Text Block is "us-gaap:InventoryPolicyTextBlock" or some similar policy is provided if the inventory components disclosure is provided.

These relations are provable using empirical evidence from the XBRL-based financial reports created by public companies. These relations are true for *each* reporting entity[25]. These relations are true across reporting entities[26]. These relations are true for *each disclosure*[27].

The disclosure mechanics rules are articulated in the form of machine-readable business rules using the XBRL definition relations[28]. Those machine-readable XBRL-based rules can be translated into a controlled natural language syntax that helps accounting professionals read and understand the business rules on their terms. Here is the information from the XBRL

[24] Disclosure mechanics rules, http://xbrl.squarespace.com/journal/2016/11/16/updated-xbrl-based-machine-readable-financial-reporting-chec.html
[25] SCOTTS LIQUID GOLD INC, http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/All/0001564590-17-005736_517.html
[26] DISCLOSURE: disclosures:InventoryNetRollUp, http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/All/Index_517_Consistent.html
[27] Disclosure Analysis Summary (work in progress), http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/All/Index.html
[28] XBRL taxonomy which contains disclosure mechanics rules for approximately 65 disclosures, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/disclosure-mechanics/Disclosures_BASE2.xsd

definition relations of the inventory disclosure[29] articulated in the paragraph above about the inventory components disclosure using that natural language syntax such as the following:



Is there an alternative where a roll up is not required for the inventory components disclosure? Perhaps. If so, then another disclosure name would be created and new disclosure mechanics rules would be created for that new disclosure. If, say, the FIFO inventory disclosure is different than the LIFO inventory disclosure; no problem, simply create a new disclosure name[30] and a new set of disclosure mechanics rules[31] for that disclosure and provide the machine-readable information for both disclosures.

And so, the logical, structural, mathematical, and mechanical relationships that make up each disclosure can be validated using automated machine-based processes. If no machine-readable rules exist for a disclosure, or if there is some logical or mechanical relationship for which machine-readable rules cannot be created; then manual processes are used to verify the appropriateness of each disclosure. But clearly, automated machine-based processes are preferable because they are more reliable and cost less.

[29] XBRL definition relations for the inventory components disclosure, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/disclosure-mechanics/517-rules-def.xml
[30] Disclosures Viewer, http://www.xbrlsite.com/2015/fro/us-gaap/html/Disclosures/Detail/index.html
[31] Disclosure mechanics rules, http://xbrl.squarespace.com/journal/2016/11/16/updated-xbrl-based-machine-readable-financial-reporting-chec.html

Manual review of non-automatable tasks

And of course, not all aspects of an XBRL-based public company financial report can be verified using automated machine-based processes. Manual verification tasks will always be required. A "to do list" of sorts helps manage these manual review tasks.

Professional accountants need to interact with an XBRL-based report at the level of the business logic of the report; not the XBRL technical syntax.

Irreducible complexity

Complexity can never be removed from a system, but complexity can be moved. The *Law of Conservation of Complexity*[32] states:

> "Every application has an inherent amount of complexity that cannot be removed or hidden. Instead, it must be dealt with, either in product development or in user interaction."

Irreducible complexity[33] is explained as follows:

> A single system which is composed of several interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effectively cease functioning.

So for example, consider a simple mechanism such as a mousetrap. That mousetrap is composed of several different parts each of which is essential to the proper functioning of the mousetrap: a flat wooden base, a spring, a horizontal bar, a catch bar, the catch, and staples that hold the parts to the wooden base. If you have all the parts and the parts are assembled together properly, the mousetrap works as it was designed to work.

But say you remove one of the parts of the mousetrap. The mousetrap will no longer function as it was designed, it will not work. That is irreducible complexity: the complexity of the design requires that it can't be reduced any farther without losing functionality.

Whether you are applying the ideas of the conservation of complexity and irreducible complexity to a mouse trap or to accounting process automation the same conclusion is apparent: **a complete chain of capabilities is necessary to realize an effective result**.

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[32] Wikipedia, *Law of Conservation of Complexity*, https://en.wikipedia.org/wiki/Law_of_conservation_of_complexity
[33] Wikipedia, *Irreducible Complexity*, https://en.wikipedia.org/wiki/Irreducible_complexity

Quality

Engineer and statistician W. Edwards Deming defined quality as "predictability," and called variance "the enemy of quality." To achieve an intended outcome, Deming thought it was important to plan for **common-cause variation**, which can be predicted, and **special-cause variation**, which cannot be predicted.

Harold F. Dodge, one of the principal architects of the science of statistical quality control, said, "You cannot inspect quality into a product." In other words, once the inspection takes place, it's too late. Rather, data from the quality inspection needs to be utilized to continually improve the process.

Management consultant Joseph Juran, who focused on management training and the human element of quality control for a variety of businesses, stated that quality is "a fitness for use."

Businessman Philip B. Crosby, who developed the concept of Zero Defects while working as senior quality engineer at aircraft manufacturer The Martin Company, defined quality as "a conformance to requirements." He warned against the **high cost of nonconformance** and said that the desired performance standard of zero defects could only be achieved through the **proper management system**.

Lean Six Sigma[34] is a discipline that combines the problem solving methodologies and quality enhancement techniques of Six Sigma with the process improvement tools and efficiency concepts of Lean Manufacturing. Born in the manufacturing sector, Lean Six Sigma works to produce products and services in a way that meets consumer demand without creating wasted time, money and resources.

Specifically, Lean is 'the purposeful elimination of wasteful activities.' It focuses on making process throughout an organization faster, which effects production over a period of time. Six Sigma works to develop a measurable process that is nearly flawless in terms of defects, while improving quality and removing as much variation as possible from the system.

While financial report quality control is generally extremely high, it is also extremely manual in nature. The modern finance platform[35] will use the techniques of Lean Six Sigma to measure and automate accounting, reporting, auditing, and analysis processes.

These same ideas can be applied to business reporting in general.

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[34] *Comprehensive Introduction to Lean Six Sigma for Professional Accountants*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.72_LeanSixSigma.pdf

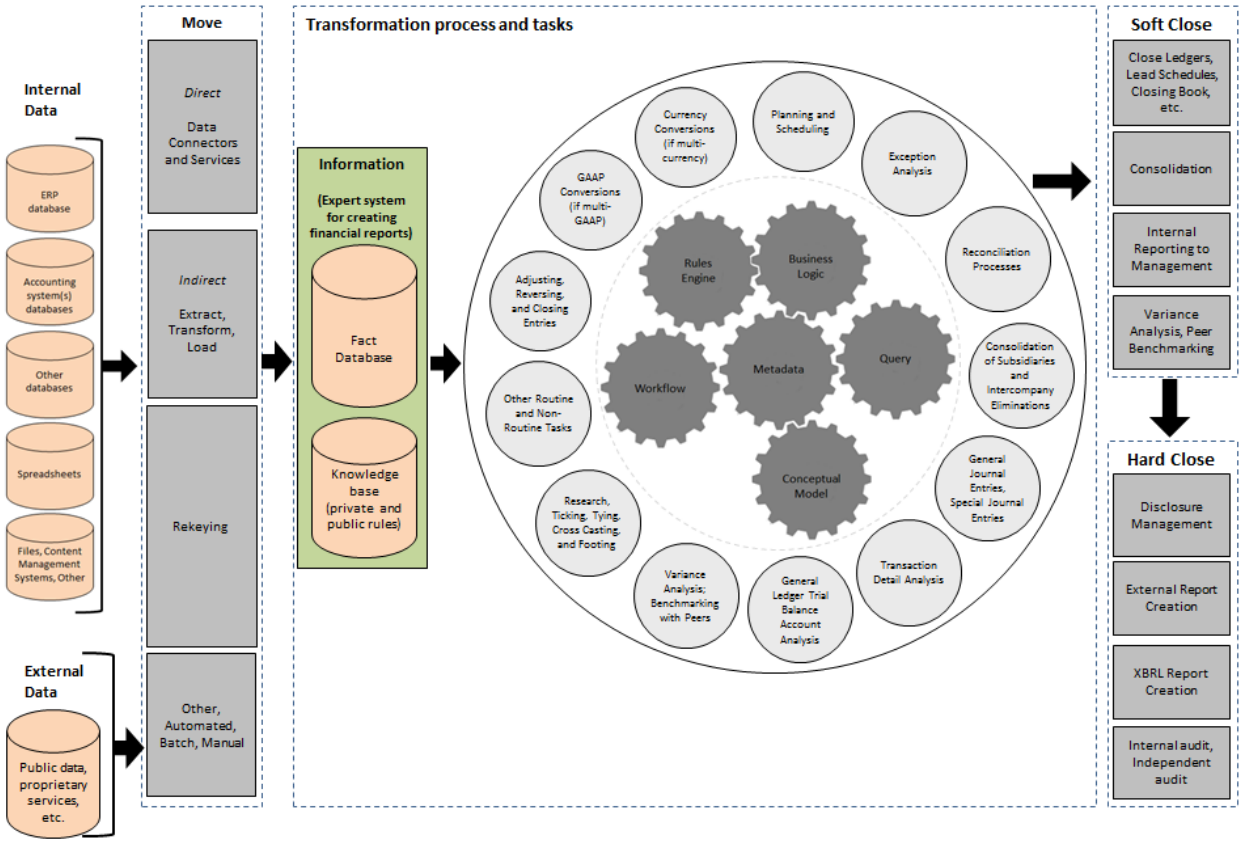
[35] *The Modern Finance Platform*, http://xbrl.squarespace.com/journal/2018/7/15/the-modern-finance-platform.html

Financial report creation process and tasks

When thinking about XBRL many think only of the final process step which they see as to bolt on new work and "tag" an already created external financial report so that the resulting report can meet a regulator mandate.

That is not accounting process automation.

Consider thinking of this in a different way. Think about the opportunity to leverage sound capabilities to verify accounting, reporting, auditing, and analysis processes and tasks at each step with the objective of automating specific tasks that can effectively be automated.



This is not a unique perspective. Companies such as Blackline already offer tools to automate accounting processes. Consider Blackline's *Finance Controls and Automation Platform*[36]. Blackline pushes ideas such as "continuous accounting[37]" and "smart close[38]" and "accounting process automation[39]" which are all part of the "the modern finance platform[40]".

[36] Blackline, *Finance Controls and Automation Platform*, https://www.blackline.com/finance-controls-and-automation

[37] Blackline, *Continuous Accounting*, https://www.blackline.com/continuous-accounting

[38] Blackline, *Smart Close*, https://www.blackline.com/smart-close

[39] Blackline, *Accounting Process Automation*, https://www.blackline.com/accounting-process-automation

Financial analysis will also benefit from improved accounting and reporting processes[41]. Analysis is simple another step in the supply chain. Supplying analysts or machines that do analysis with reliable high-quality information will significantly reduce if not totally eliminate the rekeying of information.

And then there is auditing. In their paper *Imagineering Audit 4.0*[42], Jun Dai and Miklos Vasarhelyi of Rutgers University use the term "mirror world" to describe the use of technology to create a virtual copy of the real world. Distributed ledgers, smart contracts, and XBRL help to build that virtual copy. There is a long chain of capabilities that must be mastered to make these ideas a reality.

Finally, a financial report is a type of business report. Financial reports are rather complex business reports. And so the changes that you can see happening today are likely to also transform business reporting in general. These same financial reporting tools or other similar tools can be used to create general business reports.

I am not the only one that sees this transformation to digital. Alastria[43], Auditchain[44], GovernanceChain[45], Pacio[46], and others[47] have some version of this same idea of accounting, reporting, auditing, and analysis in a digital environment.

Conclusion

As is said, "If you can measure it, you can control it." If you master the chain of capabilities that are necessary to verify that a complex document such as a financial report is consistent with statutory and regulatory reporting rules you can effectively automate accounting, reporting, auditing, and analysis processes.

By contrast if you cannot master the chain of capabilities you cannot automate such processes.

It is doubtful, to me, if processes can be automated 100%, not requiring the involvement of humans such as professional accountants at all. It is likely that the capabilities to automate processes will evolve and improve over time.

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[40] The Modern Finance Platform, http://xbrl.squarespace.com/journal/2018/7/15/the-modern-finance-platform.html

[41] Representing Unlevered Discounted Cash Flow Model Using XBRL, http://xbrl.squarespace.com/journal/2018/9/4/representing-unlevered-discounted-cash-flow-model-using-xbrl.html

[42] Jun Dai and Miklos Vasarhelyi, *Imagineering Audit 4.0*, http://aaajournals.org/doi/abs/10.2308/jeta-10494

[43] Alastria, https://alastria.io/index_en.html

[44] Auditchain, *Auditchain Whitepaper*, https://auditchain.com/Auditchain-Whitepaper.pdf

[45] GovernanceChain, Track.Capital, https://track.capital/

[46] Pacio, *Pacio overview*, https://www.pacio.io/wp-content/uploads/2018/08/stack-grid.pdf

[47] Reengineering Accounting, http://xbrl.squarespace.com/journal/2018/10/5/reengineering-accounting.html

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