Guide to Implementing Robotic Finance

Moving from old school financial reporting to a modern approach to financial reporting

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"The difficulty lies not so much in developing new ideas as in escaping from old ones."
John Maynard Keynes[1]

Executive summary:

- Whether you call it robotic finance[2], process robotics, machine intelligence[3], artificial intelligence[4], or something else; the next 20 years will bring significant change to the old school financial report creation process.

- While many are adept and describing robotic finance in high-level, general terms; to actually implement these ideas one needs to dive into the details.

- There is not one specific approach to implementing robotic finance; rather multiple approaches exist for implementing these ideas.

- To understand these new approaches you need to think differently; approaching the implementation of robotic finance from the perspective of the past old school ideas is a recipe for failure.

- When implementing a new financial reporting process using new high-tech approaches or simply improving manual processes, consider what Lean, Six Sigma, and Deming philosophies have to offer.

- Focusing only on external reporting or mandated XBRL-based reporting to regulators is to miss the point and potential opportunities offered by the ideas of robotic finance.

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[1] Brainyquote, https://www.brainyquote.com/quotes/john_maynard_keynes_385471

[2] Robert Kugel, Ventana Research, *Welcome to the Age of Robotic Finance*, https://robertkugel.ventanaresearch.com/welcome-to-the-age-of-robotic-finance

[3] Shivon Zilis and James Cham, Harvard Business Review, *The Competitive Landscape for Machine Intelligence*, https://hbr.org/2016/11/the-competitive-landscape-for-machine-intelligence

[4] Jeff Drew, Journal of Accountancy, *Real talk about artificial intelligence and blockchain*, July 2017, http://www.journalofaccountancy.com/issues/2017/jul/technology-roundtable-artificial-intelligence-blockchain.html

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Many are saying that "robotic finance" will have a profound and significant impact on professional accountants and is the future of financial reporting and accounting. They go as far as saying that perhaps one-third of an accounting department's workload will be eliminated within 10 years. I agree.

But what people don't discuss is how to implement robotic finance. That is the purpose of this document, to explain the details involved with implementing robotic finance.

This document assumes the reader understands three things. First, I assume that you understand the technologies and trend that are impacting accounting. If you don't understand these trends, please read the document ***Getting Ready for the Digital Age of Accounting, Reporting and Auditing: a Guide for Professional Accountants***[5] which will provide you with this important background.

Second, if you try and understand this information from the perspective of what the typical professional accountant has learned during their college education or continuing professional education over the past 30 to 50 years you will be projecting an inappropriate paradigm on the problems and opportunities that exist. Robotic finance is a new paradigm. To overcome this obstacle, please read the document ***Closing the Skills Gap***[6].

Third, if you are not familiar with the conceptual model of a financial report it will be more difficult, but not impossible, to make you way through this information. If you are a software engineer that desires to build software to meet the needs of professional accountants, you absolutely want to read ***Putting the Expertise into an XBRL-based Knowledge Based System for Creating Financial Reports***[7].

Automating Aspects of the Financial Report Creation Process

Robotic finance can be applied to many areas of the accounting transaction cycles and financial reporting process. In this document I will explain how I applied the ideas of robotic finance to the process of creating financial reports.

My implementation is not 100% complete. You should consider what I am showing to be a rudimentary working proof of concept that serves not as the end goal but rather as a starting point upon which additional features can be built.

The following diagram provides a graphical overview of the financial report creation process:

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[55] Charles Hoffman, CPA, *Getting Ready for the Digital Age of Accounting, Reporting and Auditing: a Guide for Professional Accountants*, http://xbrlsite.azurewebsites.net/2017/Library/GettingReadyForTheDigitalAgeOfAccounting.pdf

[6] Charles Hoffman, CPA, *Closing the Skills Gap*, http://xbrlsite.azurewebsites.net/2018/Library/ClosingTheSkillsGap.pdf

[7] Charles Hoffman, CPA and Hamed Mousavi, *Putting the Expertise into an XBRL-based Knowledge Based System for Creating Financial Reports*, http://pesseract.azurewebsites.net/PuttingTheExpertiseIntoKnowledgeBasedSystem.pdf
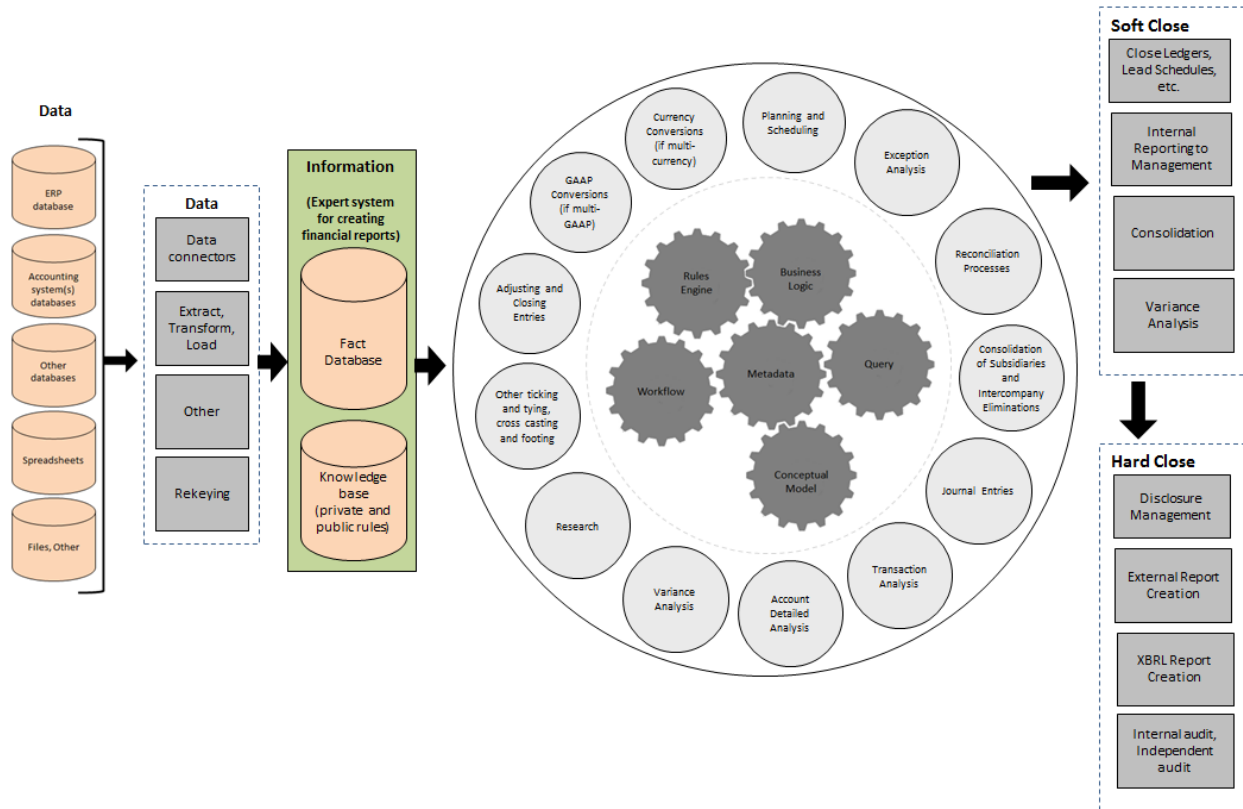
The big picture overview of this process is synthesized and summarized into the following over-arching aspects:

- **Structured information**: Historically, financial reports have been unstructured information. More precisely, historical financial reports have been structured for presentation[8] as contrast to being structured in terms of meaning. But today, XBRL and other technical syntaxes such as RDF, allow for the representation of financial information in a structured machine-readable form.

- **Machine-readable business rules**: Historically, information that explains how to create a financial report and the rich set of relations that exist within a financial report have been understandable to humans only. But today, XBRL and other technical syntaxes such as RDF, allow for business rules to be represented in machine-readable form.

- **Separation of business rules from code, using business rules engine**: Historically, the handful of business rules that did exist were hard-coded into software. In order to change those rules, create new rules, or otherwise maintain rules the information technology department needed to become involved. A different approach is possible where declarative business rules are created separate from code and then a business rules engine is employed to process those rules. This means that business professionals can maintain business rules without the involvement of the information technology department.

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[8] Charles Hoffman, CPA, *How XBRL Works*, https://www.youtube.com/watch?v=nATJBPOiTxM

Understanding Business Rules Engines

Business rules engines play a key role in implementing robotic finance. Not every business rules engine is created equal. The following graphic compares and contrasts various business rules engines:

Business Rules Processor	For more information	Information Syntax/Format	XBRL Processor	XBRL Formula Processor	Supports Inference	Problem Solving Method	Supports Probabilistic Reasoning	State Machine	General Problem Solving Logic Capabilities	Fact Database	Knowledge Base	Rule Creation Interface (XBRL Taxonomy, XBRL Formula, Other)	Understanding of Business Report Conceptual Model	Understanding of Financial Report Conceptual Model	Justification and Explanation Mechanism (Transparency into Line of Reasoning and Information Provenance)	Knowledge Acquisition Mechanisms
Arelle (Open source API level interface)	http://arelle.org/	Standard XBRL	Yes	Yes	No	Sequential	No	No	INCOMPLETE, Limited to XBRL Formula	XBRL Instance	XBRL Taxonomy	None provided	No	No	Not provided, can be created	Manual
XBRL Development Tools (Altova)	https://www.altova.com/xbrl-tools	Standard XBRL	Yes	Yes	No	Sequential	No	No	INCOMPLETE, Limited to XBRL Formula	RaptorXML+XBRL Server	RaptorXML+XBRL Server	XBRL Specific but oriented to technical users	No	No	Not provided, can be created	Manual
Sphinx (CoreFiling)	https://www.corefiling.com/products/sphinx/	Standard XBRL	Yes	Yes	No	Sequential	No	No	INCOMPLETE, Limited to XBRL Formula	XBRL Instance	XBRL Taxonomy	XBRL Specific but oriented to technical users	No	No	Unknown	Manual
Clean Score (XBRL Cloud)	https://www.xbrlcloud.com/cleanscore.html	Profile based Standard XBRL	Yes	Yes	Yes	Sequential	No	No	GOOD (Subset of RuleLog)	XML Infoset stored in file system	XML Infoset stored in file system	None provided	Yes	Yes	Good, usable by business professionals	Manual
Pesseract Knowledge Based Financial Report Creation System	http://pesseract.azurewebsites.net/	Profile based Standard XBRL	Yes	No	Yes	Forward chaining	No	Yes	GOOD (Subset of RuleLog)	XML Infoset stored in file system	XML Infoset stored in file system	None provided at present time, will be business user oriented	Yes	Yes	Good, usable by business professionals	Manual
FlexRule Business Logic Platform	http://www.flexrule.com/solution/	Proprietary or general format	No	No	Yes	Forward chaining	No	No	BETTER (Larger subset of RuleLog)	Proprietary or general format	Proprietary or general format	Comprehensive but oriented to technical users	No	No	Unknown	Manual
InRule (InRule Technologies)	http://www.inrule.com/products/inrule/	Proprietary or general format	No	No	Yes	Forward chaining	No	No	BETTER (Larger subset of RuleLog)	Proprietary format	Proprietary format	Oriented toward non-technical users and business professionals	No	No	Unknown	Manual
Smarts (Sparkling Logic)	https://www.sparklinglogic.com/smarts-decision-manager/	Proprietary or general format	No	No	Yes	Forward chaining	No	No	BETTER (Larger subset of RuleLog)	Proprietary or general format	Proprietary or general format	Comprehensive but oriented to technical users	No	No	Unknown	Manual
Fluent Editor (Cognitum)	http://www.cognitum.eu/semantics/FluentEditor/	Standard RDF, OWL, SWRL	No	No	Yes	Forward chaining	No	No	BETTER (Larger subset of RuleLog)	RDF stored in file system	RDF, OWL, SWRL stored in file system (Semantic Web Stack)	Comprehensive but oriented to technical users	No	No	Unknown	Manual
TopBraid Platform (TopQuadrant)	https://www.topquadrant.com/technology/topbraid-platform-overview/	Standard RDF, SHACL, RDFS, OWL, SPIN	No	No	Yes	Forward and Backward chaining	Yes	No	BEST (RuleLog plus)	RDF triple store repository	SHACL, RDFS, OWL, SPIN stored in file system (Semantic Web Stack)	Comprehensive but oriented to technical users; rule creation templates usable by business	No	No	Good, usable by business professionals	Manual or Automated
Ergo Logic System (Coherent Knowledge)	http://coherentknowledge.com/financial-domain-application/	Standard RDF, RIF	No	No	Yes	Forward and Backward chaining	Yes	No	BEST (RuleLog plus)	RDF stored in file system	RDF, OWL, RIF stored in file system (Semantic Web Stack)	Comprehensive but oriented to technical users	No	No	Good, electronic audit trail with provenance usable by business professionals	Manual or Automated

These business rules engines can be grouped into the following categories:

- **XBRL Formula processors**: XBRL Formula processors generally support the XBRL technical specification. This includes an inherent understanding of XBRL, XBRL Dimensions, and XBRL Formula. However, XBRL Formula processors have several significant deficiencies in terms of rule processing capabilities[9].

- **Semantic web stack**[10] **reasoners and inference engines**: Semantic reasoners and inference engines are very powerful; but they tend to be very flexible and therefore hard to use for the average business professional.

- **Business rules management system**[11] **processors**: Business rules processors tend to support a business rules approach to information which is less robust than the semantic web stack, but slightly easier to use. But still these types of systems tend to be targeted as information technology professionals as contrast to business professionals.

- **Digital business report processors**: A digital business report rules processor extends the functionality of an XBRL Formula processor and has an inherent understanding of the conceptual model of a digital business report[12]. Further, these processors can be taken even further to support the conceptual model of a financial report[13].

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[9] *Specific Deficiencies in Capabilities of Existing XBRL Formula Processors*, http://xbrl.squarespace.com/journal/2016/9/26/specific-deficiencies-in-capabilities-of-existing-xbrl-formu.html

[10] *Comparing and Contrasting Semantic Web Stack and XBRL Stack*, http://xbrlsite.azurewebsites.net/2017/Library/SemanticWebStack_XBRLStack.pdf

[11] Wikipedia, *Business rule management system*, https://en.wikipedia.org/wiki/Business_rule_management_system

[12] *Conceptual Model*, http://xbrl.squarespace.com/conceptual-model/

[13] *Financial Report Semantics and Dynamics Theory*, http://xbrl.squarespace.com/fin-report-sem-dyn-theory/

Knowledge Based System for Creating a Digital Financial Report

Ultimately, the objective is to create a system that is usable by professional accountants without the need to involve the information technology department in the process of creating a financial report[14]. Further, this process cannot be a black box that is not understood by the professional accountants using the system.

The following is a description of a knowledge based system:

> "Simply put, a knowledge based system is a system that draws upon the knowledge of human experts that has been represented in machine-readable form and stored in a fact database and knowledge base. The system applies problem solving logic using a problem solving method to solve problems that normally would require human effort and thought to solve. The knowledge based system supplies an explanation and justification mechanism to help system users to understand the line of reasoning used and support conclusions reached by the knowledge based system and presents that information to the user of the system."

The following is a graphical model of a knowledge based system:


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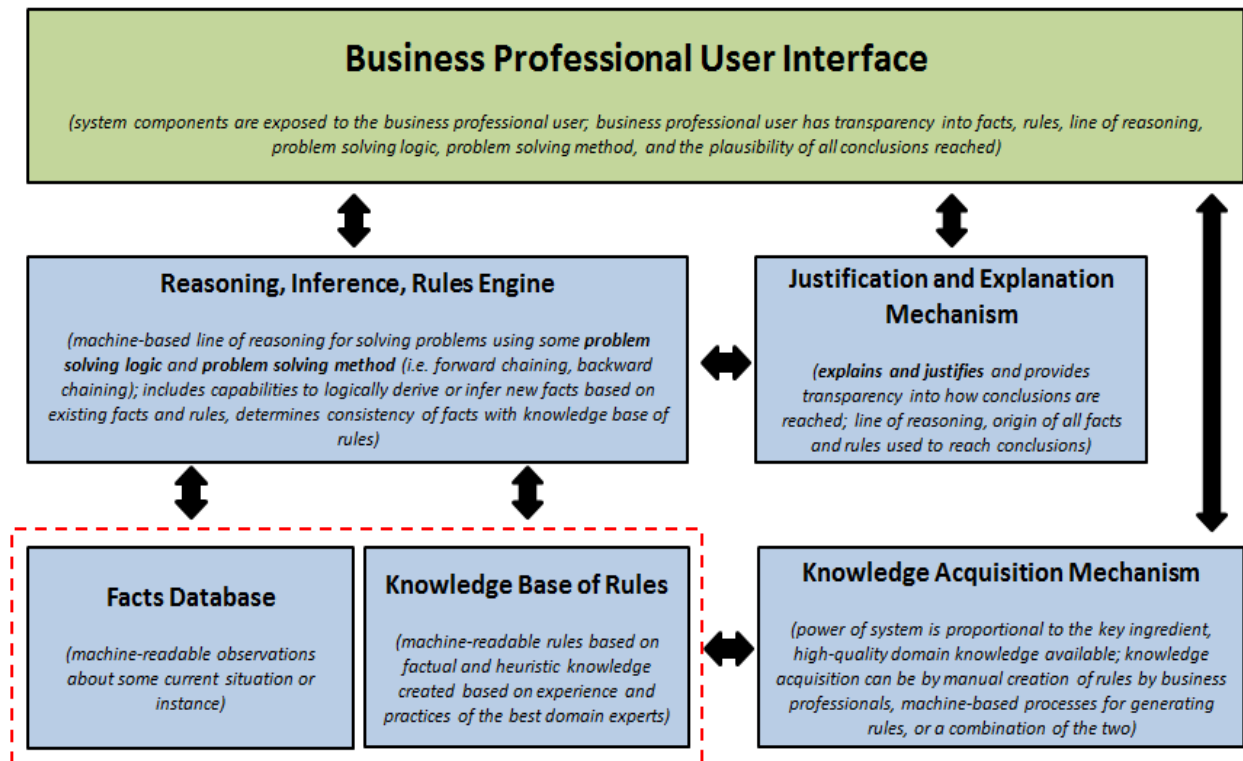
[14] *Conceptual Overview of an XBRL-based, Structured, Digital Financial Report*,
http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.1_ConceptualOverviewOfDigitalFinancialReporting.pdf

Looking at the financial report creation process in the graphic introduced earlier you see the information stored in relational databases and other data formats, stored as data, converted into information and stored in the fact database of the knowledge base.

A working proof of concept was created[15] to test the feasibility of creating such an expert system or knowledge based system.

Unifying Logic Framework for Business

It is a fact of life that multiple approaches will be used by technical professionals to implement robotic finance. But regardless of the technical implementation, the business logic of each technical implementation should be the same. This is shown graphically in the following graphic which contrasts the semantic web stack to the XBRL stack[16]:
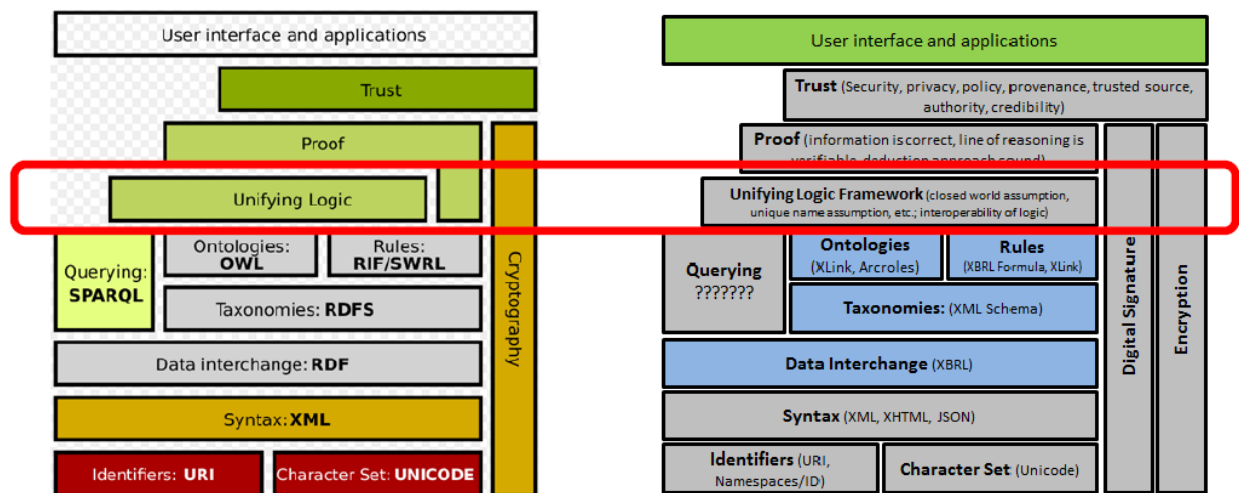
Clearly it would be inappropriate for different technical implementations to yield different results to the exact same logical situation. The business logic of an implementation should be the same regardless of the technical implementation syntax.

My Implementation of Robotic Finance Using XBRL

Having set the stage with the preceding background information I would like to invite you to consider my implementation of robotic finance using XBRL. I am not proposing that XBRL is the best or only approach to implementing robotic finance. I am merely showing my implementation in order to explain what professional accountants need from such an implementation. I do not consider my implementation complete, but it does include enough features to prove the concept and explain in detail how robotic finance can work.

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[15] YouTube, *Expert System for Creating Financial Reports*,
https://www.youtube.com/watch?v=ioapxF1gtQM&t=16s&list=PLFjXOvKVNbOrQvn_HBeyAN-hCVRZZMFJh&index=1
[16] Comparing Semantic Web and XBRL Business Reporting Stacks,
http://xbrlsite.azurewebsites.net/2017/Library/SemanticWebStack_XBRLStack.pdf

There are two documents that explain my implementations in detail. These documents are worth considering to understand the details of my implementation. The first document is ***Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports***[17]. The second document is ***Accounting Process Automation Using XBRL***[18].

The essence of both documents is to show the role of machine-readable business rules in implementing robotic finance. Key aspects of the implementation that I would like to specifically not are the following:

- **Pure global standard XBRL**: The implementation is 100% pure global standard XBRL. The report itself, all metadata, all business rules, everything.
- **Automated machine**-readable reporting checklist: One unique aspect of the implementation is an electronic version of what accountants refer to as a "reporting checklist" or "disclosure checklist". While this electronic version of such a checklist is not complete for US GAAP or IFRS reporting; it is complete for two working proof of concepts.
- **Automated machine-readable mathematical computations**: All mathematical computations are verified to be correct including roll ups, roll forwards, adjustments, variances, member aggregations, and other more complex mathematical computations.
- **Automated consistency checks**: Consistency between reported facts are checked to make sure relations within the report are logical and consistent with expectation.

Verifying Approach Using XBRL-based Reports Submitted to SEC

My approach to implementing XBRL-based financial reporting has been vetted using XBRL-based financial reports of about 6,000 public companies which have been submitted to the U.S. Securities and Exchange Commission.

The application profile used by the U.S. SEC is very similar to the approaches used by ESMA and ASIC Financial reports[19]. What I have done is distill the SEC, ESMA, and ASIC approaches into what I call a "general profiles" for implementing an XBRL-based digital financial report and more generally an XBRL-based digital business report.

This is not to say that XBRL is the only format which could be used or the best format. Rather, I am showing a model that works and which is proven by the empirical evidence of about 6,000 XBRL-based financial reports that have been submitted to the U.S. SEC and are publically available for testing.

Auto-generated Human Readable Renderings from Detail

This approach to the creation of XBRL-based financial reports was tested after the fact meaning that batch processes were run after the report had been created. This is similar to the approach taken by most public companies today, basically a "bolt-on" approach to existing processes.

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[17] Charles Hoffman, CPA, *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*, http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf
[18] Charles Hoffman, CPA, *Accounting Process Automation Using XBRL*, http://xbrlsite.azurewebsites.net/2018/Library/AccountingProcessAutomationUsingXBRL.pdf
[19] *XBRL-based Digital Financial Reporting Profiles and General*, http://xbrlsite.azurewebsites.net/2018/Library/Profiles-2018-01-24.pdf

But this is not the vision of how this process will work in the future. In the future, external financial reports will be assembled from the many fragments of information which make up a complete report. The following example will help you understand this possibility.

Consider the following fragment of information that would contribute to the creation of a financial report:

Long-term Debt [Roll Forward]	Period [Axis]
	2018-01-01 - 2018-12-31
Long-term Debt [Roll Forward]	
Long-term Debt, Beginning Balance	1,000
Additional Long-term Borrowings	6,000
Repayment of Long-term Borrowings	(1,000)
Long-term Debt, Ending Balance	6,000

That detail can be automatically rendered into formats that are used to create, say, a 10-Q or 10-K filing. Here is a basic example:

Long-term Debt Roll Forward

(in US Dollars)		
Beginning Balance at December 31, 2017	$	**1,000**
Additional long-term borrowings		6,000
Repayment of long-term debt		(1,000)
Balance at December 31, 2018	$	**6,000**

Complexity of Information

The auto-generated information in the above section is not very complex. If you look at something like the financial report of a 10-K, such as reports submitted to the SEC, one might conclude that those 10-K financial reports could never be represented using the schemes I have shown above and that the complexity of such reports would prohibit the auto-generation of human-readable representation (Inline XBRL) from machine-readable representations (raw XBRL).

However, this is not the case. Yes, it is true that the volume of disclosures is higher. But, if you analyze the disclosures themselves as I have[20]; they you recognize that the volume of disclosures really has no impact on conversion from raw XBRL to the more readable Inline XBRL or any other format for that matter. Further, the validation used to assure information quality is not any different; it is simply more voluminous.

That said, I would acknowledge that it is very conceivable that someone could come up with some specific representation that is so complex that it cannot be handled by the validation rules specified here to assure quality or the rendering capabilities of the demonstrated in this document. Basically, one could "break" this scheme most likely if one tried by trying to concoct complexity. However, it is also

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[20] Disclosure Best Practices, http://xbrlsite-app.azurewebsites.net/DisclosureBestPractices/DisclosureBestPractices.aspx?DisclosureName=BalanceSheet

true that complexity can be distilled and reduced to make information representations simple enough for the schemes I am pointing out work safely, reliably, and predictably and have no loss of the complexity of the information conveyed by such reports.

As XBRL-based digital business reporting evolves the complexity and sophistication of information that can be represented by schemes to make complex information readable by both humans and computers to work effectively with the information because quality can be controlled will improve even more. This is not to say in any way that what exists right now is insufficient; it is very useful right now. Consider the fairly simple looking test cases[21] that I have been working with and a similar test case using a complete 10-K financial report submitted to the SEC[22].

The challenging task right now is to be able to "separate the wheat from the chaff" within all those XBRL-based financial reports submitted to the SEC. Because of quality problems[23], because of information representation problems[24], because of US GAAP XBRL Taxonomy metadata deficiencies, because I don't have a complete set of metadata[25] for US GAAP or IFRS, because a lack of the correct software to process reported facts and supporting metadata; but mainly because of a lack of understanding by business professionals[26] of what it takes to makes such knowledge based systems work effectively; understanding this document and other information can be a challenge today.

However, the issues above will be addressed one-by-one, fewer barriers will lay in the way, business professionals will be trained to understand, and the information provided by this guide and by other documentation will help those trying to make robotic finance work to serve the needs of business professionals.

Focus on Internal and External Reporting

Because the processes of many public companies are currently "bolt-on" processes that focus on simply generating the mandated XBRL format that must be submitted to the SEC; current processes are not a good indicator of how processes could be set up.

The document *Accounting Process Automation Using XBRL: Elegant, safe, reliable accounting process and financial report creation automation leveraging the global standard XBRL[27]* should be examined closely. Take notice of the roll forwards of every balance sheet account that are used to create the required disclosures. Further, take note of the "Transaction Description Code" that is assigned to each

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[21] *Guide to Implementing Robotic Finance*, http://xbrl.squarespace.com/journal/2018/3/30/guide-to-implementing-robotic-finance-draft.html

[22] *More Brainstorming on Implementing Robotic Finance*, http://xbrl.squarespace.com/journal/2018/4/5/more-brainstorming-on-implementing-robotic-finance.html

[23] *Quarterly XBRL-based Public Company Financial Report Quality Measurement (Mar 2018)*, http://xbrl.squarespace.com/journal/2018/4/1/quarterly-xbrl-based-public-company-financial-report-quality.html

[24] *Understanding Logical, Mechanical, and Mathematical Accounting Relations in XBRL-based Digital Financial Reports*, http://xbrl.squarespace.com/journal/2016/12/15/understanding-logical-mechanical-and-mathematical-accounting.html

[25] *Conceptual Model*, http://xbrl.squarespace.com/conceptual-model/

[26] *Closing the Skills Gap*, http://xbrlsite.azurewebsites.net/2018/Library/ClosingTheSkillsGap.pdf

[27] Charles Hoffman, CPA, *Accounting Process Automation Using XBRL: Elegant, safe, reliable accounting process and financial report creation automation leveraging the global standard XBRL*, http://xbrlsite.azurewebsites.net/2018/Library/AccountingProcessAutomationUsingXBRL.pdf

transaction within the general ledger[28]. This transaction description code is a US GAAP XBRL Taxonomy concept where the concepts are provided and extension concepts where they are not provided. These codes are used to document the nature of the general ledger transaction and therefore where the information would be provided within a financial report. These codes are used in the process of aggregating disclosure information, organizing transactions, and otherwise do within the general ledger what is many times done external to the system using spreadsheets. This process has many advantages including maintaining a proper audit trail, enabling drill down functionality for analysis, and automation of the report creation process.

Pre-close Roll Forward Level

Line	General Ledger Account Code	Transaction Description Code	Amount
1	basic:AccountsPayable	basic:OpeningBalance	-1000
2	basic:AccountsPayable	basic:PaymentOfAccountsPayable	2000
3	basic:AccountsPayable	basic:PurchasesOfInventoryForSale	-2000
4	basic:CashAndCashEquivalents	basic:AdditionalLongtermBorrowings	6000
5	basic:CashAndCashEquivalents	basic:CapitalAdditionsPropertyPlantAndEquipment	-5000
6	basic:CashAndCashEquivalents	basic:CollectionReceivables	3000
7	basic:CashAndCashEquivalents	basic:OpeningBalance	3000
8	basic:CashAndCashEquivalents	basic:PaymentOfAccountsPayable	-2000
9	basic:CashAndCashEquivalents	basic:RepaymentLongtermBorrowings	-2000
10	basic:CostsOfSales	basic:CostsOfSales	2000
11	basic:Inventories	basic:CostsOfSales	-2000
12	basic:Inventories	basic:OpeningBalance	1000
13	basic:Inventories	basic:PurchasesOfInventoryForSale	2000
14	basic:LongtermDebt	basic:AdditionalLongtermBorrowings	-6000
15	basic:LongtermDebt	basic:OpeningBalance	-1000
16	basic:LongtermDebt	basic:RepaymentLongtermBorrowings	2000
17	basic:PropertyPlantAndEquipment	basic:CapitalAdditionsPropertyPlantAndEquipment	5000
18	basic:PropertyPlantAndEquipment	basic:OpeningBalance	1000
19	basic:Receivables	basic:CollectionReceivables	-3000
20	basic:Receivables	basic:OpeningBalance	1000
21	basic:Receivables	basic:Sales	4000
22	basic:RetainedEarnings	basic:OpeningBalance	-4000
23	basic:Sales	basic:Sales	-4000

(Note that basic:Sales and basic:CostsOfSales have not been closed to basic:RetainedEarnings yet.)

Again, this is not to say that every line item of every roll forward would be disclosed in an external financial report. The reason for the line items in the reporting system is to manage the report creation process.

If you look back at the graphic that describes the financial report creation process (see page 4) you will recognize that the tasks that are preformed to create a report are generally to either (a) post a transaction or to (b) look for errors within an accountant which would result in posting a transaction to correct any errors that are discovered. Fundamentally, management of the financial report creation

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[28] Charles Hoffman, CPA, Transactions Prototype, http://xbrlsite-app.azurewebsites.net/Transactions/#menu3

process is structuring the flow correctly and then managing the transactions that make up the information that ultimately ends up within the report.

So again, don't look at this as a process that manages all disclosures. This process manages all information some of which ends up being disclosed within the externally released financial report.

Lean Six Sigma and Deming

To make robotic finance succeed, maintaining the high-quality that exists today is crucial. Creating a new process that yields output that is not up to the high standards of current financial reporting processes is a dead end. The effectiveness should not change at all. What will change is the efficiency with which that high-quality end result is achieve. Weaving together new more efficient processes using new techniques offered by today's technologies is what will make robotic finance succeed.

The ideas of *Lean Six Sigma*[29] and philosophies of Dr. W. Edwards Deming have a lot to offer in this reworking of finance and accounting processes.

KPMG explains the benefits of Lean Six Sigma to professional accountants[30]. LEANCPA provides this explanation of Lean Six Sigma[31]:

> **"Lean Six Sigma** is a discipline that combines the problem solving methodologies and quality enhancement techniques of *Six Sigma*[32] with the process improvement tools and efficiency concepts of *Lean*[33]. 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 your firm faster, which effects production over a period of time. Six Sigma works to develop a process that is nearly flawless in terms of defects, while improving quality and removing as much variation as possible."

Dr. W. Edwards Deming[34] provides a philosophy related to thinking about systems, quality, and management. Deming focuses on quality and continuous improvement. Deming's view of systems theory[35] offer a lot in terms of techniques and philosophies which can be applied to robotic finance. His views are summarized in his 14 key principles[36] of transforming effectiveness.

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[29] Praveen Gupta, Quality Digest, *Six Sigma in Finance and Accounting*, https://www.qualitydigest.com/inside/six-sigma-column/six-sigma-finance-and-accounting

[30] KPMG, *Benefits of Six Sigma for Accounting Professionals,* https://www.slideshare.net/HenryHarvinEducation/benefits-of-six-sigma-for-accounting-professionals

[31] LEANCPA, *What is Lean Six Sigma?*, http://www.leancpa.net/what-is-lean-six-sigma

[32] Wikipedia, *Six Sigma*, https://en.wikipedia.org/wiki/Six_Sigma

[33] Wikipedia, *Lean Manufacturing*, https://en.wikipedia.org/wiki/Lean_manufacturing

[34] British Library, *W Edwards Deming*, https://www.bl.uk/people/w-edwards-deming

[35] YouTube, *A Theory of a System for Educators and Managers*, https://www.youtube.com/watch?v=2MJ3lGJ4OFo

[36] YouTube, *Deming's14 points for Management*, https://www.youtube.com/watch?v=edE0Cli943k

Conclusion

Robotic finance is not about magic. The idea of robotic finance is a good idea whose time has arrived.
The many pieces of the puzzle that are necessary to make this idea work are available. Arguably, global
standard approaches are better than proprietary approaches; philosophies and techniques offered by
Lean, Six Sigma, and Deming can be leveraged as processes are rethought. Ultimately to implement
robotic finance you have to dig into the details. This paper offers many, but not all, of those details for
your consideration. While my implementation is created using the XBRL technical syntax, it is highly
likely that multiple implementation approaches will be available and serializations into many different
structured technical syntax formats will be possible.

For more information please subscribe to my blog: http://xbrl.squarespace.com/blog-archive/