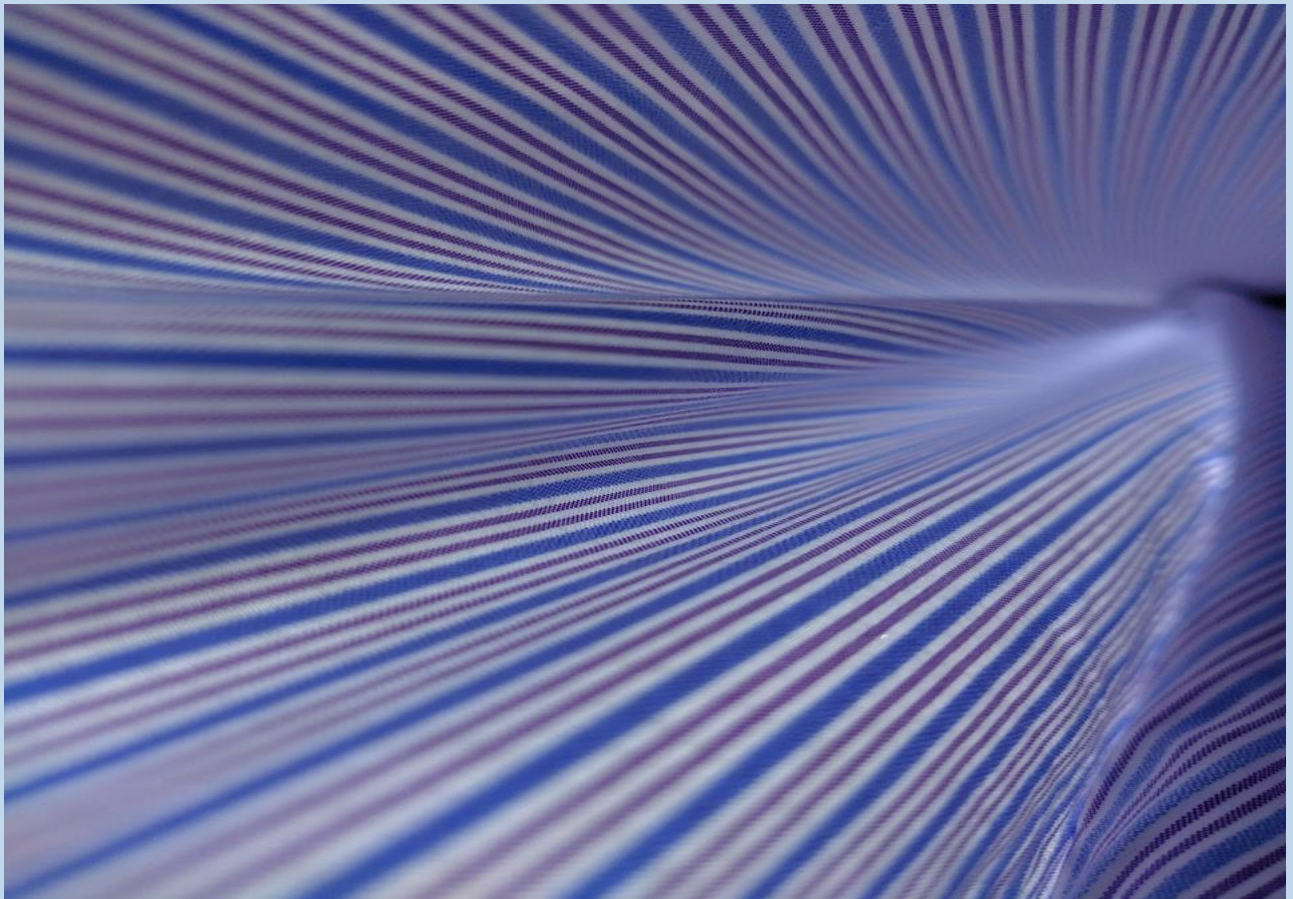


Issue No. 20, Spring 2024

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*Think***TWENTY20**

The Magazine for Financial Professionals



SPECIAL FEATURE – AN INTERVIEW WITH BOB TAPSCOTT

- - How “Trivergence” Will Soon Make Science Fiction a Reality

Adding Rigor to Sustainability Reporting

How Will the Updates to OSFI Guidelines B-10 And B-13 Help

Financial Institutions Mitigate New Risks?

Accounting Makeover using Generative AI



Number 20, Spring 2024

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The Office of the Superintendent of Financial Institutions (OSFI) is at the forefront of trends in the industry, and recently updated its guidelines to help financial institutions address new risks. These guidelines apply to federally regulated financial institutions (FRFIs) — however, they reflect some of the most pressing threats across the financial services industry today.

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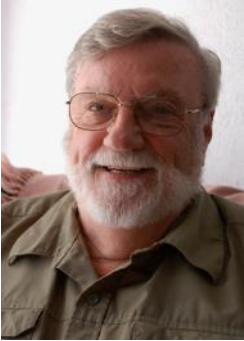
By Jaideep Shah

Generative Artificial Intelligence (Generative AI) has emerged as a transformative force across many domains. While its most talked about impact has been that in its revolutionization of chat bots, it has become a valuable asset in software development unlocking unprecedented potential for efficiency and innovation.



University of Waterloo Centre for Information Systems Security and Assurance

Editorial



Gerald Trites, FCPA, FCA, CISA
Editor-in-Chief

The rapid development of AI is in process of pervading everything we do as accountants and financial professionals. It's not just AI that is affecting us. It is really a number of important recent developments in technology, including AI but also technologies like blockchain and Internet of Things (IoT), which are having a major impact on us.

In this issue, Bob Tapscott, best selling author and visionary, talks with Gundi Jeffrey, our Managing Editor about "trivergence", which is defined as the merging of AI, blockchain and IoT. It reminds us that these technologies are proceeding apace, and becoming more and more entwined in their scope and actions. We have become used to many of our possessions, such as cars, computers, security systems, phones and so on collect information and then distribute that information to others for various uses. As the technologies spread, IoT continues to spread as well, almost unnoticed. Blockchain and AI facilitate the handling of that information and generative AI is speeding up the process tremendously. Tapscott's book explores this phenomenon in depth and with unusual insight and is a work we heartily recommend.

Jaideep Shah adds to the insight into AI in this issue with his article on the effects of AI on software development and the implications for the world of accounting and finance. Major!

AI will continue to be a huge factor in the continuing development of accounting and finance and generative AI has generated (sic) much of the current excitement. It's worth noting, however, that Generative AI is not the end of the line. Newer and even more powerful types of AI are on the horizon and we will hear more of these in future issues. Stay tuned!

/GDT

How “Trivergence” Will Soon Make Science Fiction a Reality: In Their Own Words

By Gundi Jeffrey



Gundi Jeffrey is an award-winning business journalist specializing in writing about the accounting profession for various publications in Canada and England. In 1985, she co-founded The Bottom Line, then Canada's only independent publication for the accounting and financial professions, serving as its executive editor.

Bob Tapscott, writer, speaker, complex system designer and former chief information officer, has written a fascinating new book on technology – *Trivergence: Accelerating Innovation with AI, Blockchain, and the Internet of Things* – that is bound to change the way we think about technology and how it is shaping our future.



Tapscott’s book introduces an exciting new concept in explaining how the intersection of Artificial Intelligence (AI), blockchain and the Internet of Things (IoT) will transform business and society. He explains the synergies between these technologies and the disruptive potential that they will offer, as well as the challenges and risks to making it happen. He then offers an insightful guide to help us through the difficult decisions that businesses and society must make to thrive in a new era where decisions will be difficult and uncertainties abound.

Tapscott explains how and why AI's power is now exploding, its growth driven by smarter approaches to neural networks trained on a new hardware architecture that can derive its intelligence from ever more massive datasets. He also discusses the multiplicative and exponential power of trivergence on the core technologies discussed in the book.

A fresh and innovative guide, rich with case stories, on how the most critical technologies of this new phase in the digital age are combining to drive business transformation, *Trivergence* will become a

critical handbook for forward-looking leaders, and anyone interested in the intersection of cutting-edge tech and business.

ThinkTWENTY20 sought an interview with Tapscott to learn more about his book and the ideas he explores in it and how financial professional can take advantage of the insights he offers.

ThinkTWENTY20: *First we'd like to know a little more about you. Can you give us a brief biography to date?*

Tapscott: I have an extensive background as a CIO, a speaker and as a consultant in successfully developing and implementing disruptive strategies from concept creation through systems design and implementation including the training, organizational restructuring and workflow redesign required to deliver, measure and improve corporate performance and customer satisfaction. My background also includes developing and deploying complex systems from nuclear power reactor maintenance to Wall Street derivatives, to flying commercial aircraft by computer all emphasizing the prudent mitigation of risk.

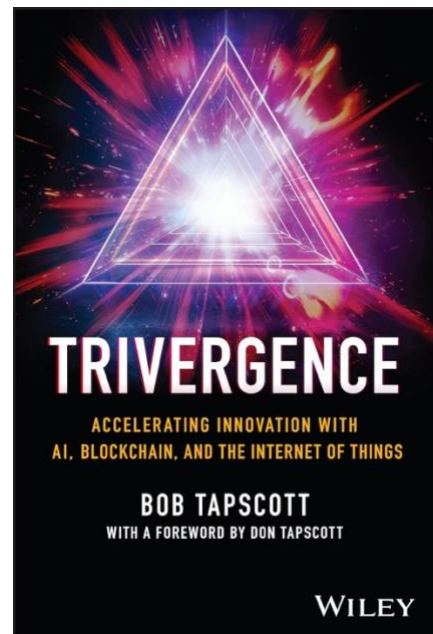
ThinkTWENTY20: *I've been reading your book, which I love because it's easy for people like me to understand. And you make it all sound so reasonable and comprehensive. But the best part is that it speaks of hope for the future. So many people are afraid of this kind of artificial intelligence and related technologies. And I think that, if they read your book, they'll have the hope to believe there's going to be a better future. I'd love to know what inspired you to write this book in the first place?*

Tapscott: Well, thank you. I think that, in 10 years or 12 years, what I now write and talk about is going to transform society far more than the Industrial Revolution did over a couple of centuries. I think the potential is awesome. And I think we could end up with a much better richer future for all of us. Or, as some people have articulated, we could end up with something Orwellian.

What I was aspiring to do through this book was to bring the issues associated with decisions that are critical to determining the outcome and make it available to a much broader audience of people.

ThinkTWENTY20: *You say, in your book and elsewhere that, today, digital technologies permeate every facet of life and business, from 5G networks, virtual reality and drones to robotics, additive manufacturing and synthetic biology. Of these technologies, you say, three have emerged as foundational: AI, blockchain and the Internet of Things. Can you explain to us why and how they are foundational?*

Tapscott: All three technologies have been around for over a decade. Computerized AI efforts go back to the 1960s. My efforts in terms of AI go back to the 1980s, which is a period in which I gave it an honest attempt, and I failed, as did pretty well everyone in that era. But, of the three



technologies, blockchains are the newest, yet still have been around since 2009. IoT sensors have been around since the 1990s.

I think that what these technologies can do individually is impressive, but the collaboration, the synergies between the three are going to have a very quick and very profound impact.

Way back in 2010, Professor Peter Domingo identified what he called the five main tribes or approaches within AI.

The first I had some success with back in the 1980s, with what are called Symbolists or Rules-based systems. The basic idea of was to sit down with a domain expert, and learn what you could of their discipline, and then you'd hard code that into a system. These approaches were very successful in law, and they were somewhat successful, in medicine.



The second is what are called evolutionaries or genetic programs where you would fire up a whole bunch of different models that could generate other models, and the models would hopefully learn from experience, and you'd end up with a "survival of the fittest model," where the more predictive ones survive.

The third approach is what are called Bayesian or probabilistic learners. This approach has roots in the 18th century and uses probability theory to find a result. Think political polling.

The fourth approach is what are called analogizers or instance-based learners." Here you take a look at a new problem and, like the conscious mind, you try to find the closest analogy to that particular problem.

The fifth approach that is revolutionizing AI and ultimately society today, and is a corner of the Trivergence Triangle, is based on the concept of neural networks, like we have in our brains. Based on how the human brain works, this approach was first envisioned back in the 1940s by Walter Pitts and Warren McCulloch. This approach is elegant and beautiful, but it's been tried and failed and tried and failed every decade since the birth of the IBM personal computer.

But, in this century, three professors, Yoshua Bengio, Yann LeCun and Geoff Hinton, learned how to make these neural networks smarter by what is called "backpropagation." In the simplest of terms, this means developing systems that think and go back and rethink. And that is one corner of the Trivergence Triangle. But, without the other two corners, its contribution would be far more limited.

Tapscott's book introduces an exciting new concept in explaining how the intersection of Artificial Intelligence (AI), blockchain and the Internet of Things (IoT) will transform business and society.

Back in 1970, an engineer at Intel came up with what was called Moore's Law, which basically says the density of transistors on a chip would double about every two years. For the last 50 years, Moore's Law has been a reasonable predictor of the advances in the speed memory of computers. And, based on that law in the last 50 years, computers have seen a roughly a 50-fold increase in power decade after decade. That is staggering. But what has happened is a change in hardware architecture that has focused on massive parallelism. What that basically has done is it's made Moore's Law obsolescent for certain types of problems.

It all started with graphics chips, which are much simpler and smaller – and smaller means faster that could calculate in massive parallelism the different dots that make up the screen. As it turns out, with the dawn of the crypto era, people found out that they were far faster at finding that magical nonce to win crypto when it came to crypto mining. As a result, this architecture was heavily funded during the pandemic.

Instead of processing, say on the high-end Intel chip, which can process maybe 24 things at a time, you have a graphics card calculating thousands of processes in parallel that for crypto would try and guess the right number to win the crypto lottery. Then, mining went from graphic cards to specialized cards that were designed for mining that could calculate with massive degrees of parallelism. And by massive, I mean tens of thousands or hundreds of thousands of parallel processes simultaneously.

What that did is that, for tasks that could be formed in parallel, it obsoleted Moore's Law. And, as it turned out, the design of massive parallelism for crypto, which was heavily funded, turns out to be perfect for processing neural networks because, for a neural network with trillions of nodes, you need mountains of data to be processed to create these trillions of nodes.

In fact, the more data and the more credible data you have, the more intelligent your AI system is. Thanks to blockchain, we have an explosion in the power of AI processing. And thanks to the Internet of Things, we have an explosion in data that AI can use to make intelligent decisions.

The result of the trivergence will be the creation of very smart AI applications, a decade before most experts expected.

I'd like to go back to my first personal experience with the Internet of Things. I was working at North America's largest nuclear reactor complex. And then back in the 1990s, sensors were put in place almost everywhere to monitor temperature, pressure, humidity, vibration, light – anything they could think of.

The idea was simple. If they could make a more intelligent decision in terms of how long they could keep the reactor processing, or God forbid, evoke a timely shutdown if there was a potential accident. The business case for the sensors was overwhelming. That reactor complex makes hundreds of thousands of dollars per hour. Then just one more hour of uptime could pay for a heck of a lot of very expensive sensors.

Today, sensors are near free. They're everywhere. A car today can easily have 3,000 sensors. So, be it an MRI scanner or a T3 thyroid tester or your home appliances, all of these are now, through the Internet of Things, gathering data and supplying it to, among other things, AI engines.



What basically has happened is that, through the trivergence of advances funded by blockchain in terms of parallel processing architecture, and the Internet of Things devices going from thousands of dollars per device to pennies per device, we have a ton of data with much faster processing capability, with much smarter AI engines, all triverging at the same time for an explosion in AI capabilities.

We're now seeing in

the last decade that, instead of that traditional 50-fold increase in power per decade, an increase in power of a million times in the last decade, which has stunned even those in the AI industry.

ThinkTWENTY20: *One little question that keeps running through my mind is with regard to the Internet of Things. The idea, of course, is that, as you say, getting additional data from the various things. And my question really runs around how many of those things out there are*

actually generating useful data for AI systems at this point. The reason I ask that is because “the things,” if you like, theoretically cover almost everything we see around us, all the appliances, all the vehicles, everything else. And so, in terms of today's state of things, where would you place the Internet of Things in terms of data availability for AI and so on, on a spectrum of where it is now, as opposed to where it could be down the road?

Tapscott: Well, these devices gather an insane amount of data. You can have an IoT device giving updates every second. This leads to a whole bunch of issues in terms of filtering so that it keeps just the relevant and pertinent information. Also, typically today, through the Internet, it's all stored on the cloud. So, the devices are getting smarter. They're soon going to be inside our bodies.

The devices that take medical tests are gathering a staggering amount of data. To take a simple example, MRI machines are now connected to the Internet. And, if you have 100,000 brain scans and the interpretations of those brain scans, an AI engine can take a look at it and see and recognize patterns. Today, it is better at interpreting an MRI scan of the brain than 97% of professionals who are trained to do that. And, of course, their ability is increasing every day.

Trivergence for reporting corporate information means that you're going to be able to talk directly to the computer system – through the AI engine – and it will be able to instantly slice it and dice it in any way that you want.

ThinkTWENTY20: *But you have also noted that the technologies we are already using pose challenges that trivergence can help overcome. Can you outline a few of those and how trivergence can help resolve them?*

Tapscott: This new technology, like every technology, has gone through what Gartner calls the period of inflated expectations to the trough of disillusionment. It can do many different things. And it will do many more different things. But it's a relatively early technology and there's some technical challenges and issues associated with it, but those are being worked out over time.

ThinkTWENTY20: *Overall, how can the three technologies affect and transform the work of financial professionals? In what areas might they be most useful? For example, how can they help transform corporate reporting?*

Tapscott: If I can go back to the most extensive corporate reporting effort I ever did, it was at one of the US RBOCs (Regional Bell Operating Companies) for 14 states. There, I implemented a Business Intelligence system that allowed you to slice and dice the financial information by a vast number of factors. When it went live, I had some interesting observations.

The first thing that I found surprising was that, because you were in charge of business intelligence, people thought you were intelligent. People would call in and say, “I see for this particular demographic in Iowa, sales are up for this product, and yet they're down in Omaha. Why would that be?” Unfortunately, I had absolutely no clue.

When I presented this system to the CFO, who was an older gentleman with about a thousand employees, he had no interest in using the system since he could get the same information by making a phone call.

When I asked him what the response time on the phone call was, he said it'd be within a day or two. When I then talked to his staff, they found the system incredibly useful, and eliminated those days of effort, but it didn't get wide acceptance in the company until it was put on cell phones. Then, all of a sudden, when people were chatting in the hall or getting on an elevator, they were discussing graphs they could load on their cell phones – that was something that was very powerful.

The trivergence for reporting corporate information will be a transformation. It means that you're going to be able to talk directly to the computer system – through the AI engine – and it will be able to instantly slice it and dice it in any way that you want. Also, an AI engine can go out and browse the internet or other data sources and potentially come up with far greater insights. And, based on other data it peruses, it might be able to give insights in terms of what's happening in Idaho versus Iowa. (Say, a competitive sale that it picked up by scanning advertisements on the net, something I did not do.)

The answer to your question is that AI is going to dramatically simplify corporate reporting and make it far less onerous than it is today. Based on understanding your history it might even suggest month-end adjustments, which may be appropriate.

ThinkTWENTY20: *What other areas of interest to accountants and CFOs might be affected and transformed? Can they, for example, be useful in detecting and preventing the ever-increasing number of cyberscams?*

Tapscott: Tough question. There's some bad news and there's some good news. The bad news is that a scammer is far more believable when it looks and sounds exactly like your nephew. And those days are not far out. Before, antivirus software would look for known infections or some other type of scam. What AI can now do is look for something similar to scams that it's seen before. So, it's far more intelligent. That means there will be a race between scammers implementing AI and those who are trying to prevent scams by implementing AI.

Sadly, I have to say that the winner will likely be those that profit most from the implementation of these technologies. I mean that an AI engine can take a look at something and say, "I'm deeply suspicious," but it's going to be quite a while before human judgment is not critical to that process. It's really scary when you think about that.

Now, with the regular scams we get every day on the phone, we usually can recognize those very quickly, even just by looking at the number or as soon as we answer the phone and it says, "your account has been suspended" things of that nature. It takes just a moment to recognize it's a scammer.

But as scammers get more sophisticated, using deep fakes and other tricks, it'll be much harder, perhaps almost impossible to tell. There's an educational process involved here. For instance, if your nephew phones saying that he needs to be bailed out of jail and is terrified of telling his parents, you're going to have to have some test questions that you know the answers to. For example, "What was your favorite dessert when you were six years of age? Who was your best friend in grade nine?" If the image that looks exactly like your nephew and talks exactly like your nephew and has the exact idioms and expressions of your nephew, but doesn't know the answer to those questions, you hang up. There still will be a human thinking component.

One other thing trivergence has got to do is to make our lives simpler, more productive and reduce the overall work week.

ThinkTWENTY20: Also, how, for example, might these technologies affect the growing use of cryptocurrencies and the challenges this area continues to face. There's a lot of weird stuff going on there as well. How is Trivergence between the AI blockchain and the Internet of Things going help us there?

Tapscott: First of all, blockchains are a cornerstone fundamental to this transformation. In the book, I cover cryptocurrencies and some of the strengths and weaknesses associated with them. But to say that blockchains are just about cryptocurrency is misleading.

There have been some big challenges in the cryptocurrency arena. Cryptocurrencies are unregulated, the number of scammers and the lack of transparency in determining the drivers behind the wild fluctuations in the currencies should indicate that buyers should definitely beware. But one of the great things about blockchains is also one of its greatest curses.

One of the beautiful things about blockchains is that they're immutable. And one of the horrific things about blockchains is that, if there's an error in the database, which I have in banks as a programmer spent many a sleepless night trying to undo, it can't be undone.

When you're building and designing systems, immutability has to be managed in such a way that it gives you great insights in terms of what happens. But, if it's your database of record, it can be the ultimate curse. In fact, there have been DAOs and other projects where have found that somehow a bug or a hacker or whatever has put an erroneous entry into the database. And then the organization has to fold because there's simply nothing it can do about it. Immutability can be a curse.

Smart contracts can perform independent services without central control. Revolutionary and powerful. But if the price you pay in crypto (to run them), can double or triple in one week or fall 80% in another week, you may have no clue what the future price of running these services will be.

So, there is another challenge. The throughput of blockchains is limited and may not be able to grow with your business. I'm sure this issue will be solvable, but in terms of stability of crypto price and in terms of immutability of crypto, these are issues that require a great deal of



thought in terms of how you design, build, and implement these systems.

ThinkTWENTY20: *Trivergence, it seems, according to what we've been talking about, is driving disruption across various sectors, redefining what's possible and setting the stage for a future where smart, connected and secure systems are the norm. Can you paint me a*

clearer picture of how this is happening? And again, how financial professionals can benefit?

Tapscott: First of all, AI is not that smart at the moment, but its level of intelligence will increase dramatically. And, for the next five or 10 years, that's good news for financial professionals because it will be able to automate many of the mundane aspects of being in the business, be it reporting or risk management. Expect AI to give stunning insights and new perspectives on your business, some brilliant, and some not at all.

It's going to be able to free up a fair bit of time. McKinsey believes that, say, over a 10-year period, the benefit may be around \$300 or \$400 billion to the financial services industry.

They talk about increases of productivity below 5%, but I personally think that it could be higher.

ThinkTWENTY20: *You also note, in your book, that the more we combine the three technologies — AI, blockchain, and IoT — the more we realize that the “era of trivergence requires collaborative effort.” Please explain what you mean by this and how you envision this taking place.*

Tapscott: The ultimate nightmare is that the technology becomes completely centralized – and you can make an argument that it will be completely centralized because only Microsoft, Facebook and Amazon have the massive computer complexes required to look at trillions of pieces of data. ChatGPT is rumored to have hundreds of trillions of nodes.

So, there's a good possibility that we end up with something highly centralized and, instead of talking about people who are worth hundreds of billions of dollars, ending up with a few worth trillions of dollars. This is certainly not the future I envision or would argue for in my book. So, a collaborative effort is required to ensure that as many people as possible share in the benefits

that trivergence offers. I think that, as productivity increases, we end up with higher standards of living and shorter work weeks.

Think of bringing education and medicine to the third world. Think of a transformation in education where we teach people how to learn as opposed to memorizing a whole bunch of rote facts – the paradigm needs to dramatically shift. That can clearly be the case.

ThinkTWENTY20: *According to your book, “trivergence will soon make science fiction a reality!” How do you see the near future of automation evolving? What next can financial professionals expect to see happening in their workspace – and how can they best learn to take advantages of those changes?*

Tapscott: Let's go back 100 years for a vision of the future. John Maynard Keynes believed that, with the technology that was being developed way back in the 1930s, that would mean that today, when you ask someone what they did, they would be defined by their hobbies and not by their work. People would have a much higher standard of living and be working 15 hours a week he conjectured.

I think that is still a distinct possibility – what is quickly coming down the pike might be overwhelming. That, for the next period, I think we're going to see dramatic increases in productivity, and I hope in terms of wages. And I also hope to soon see the four-day work week.

But, once we get to the 2030s, will the Trivergence, which has then increased our productivity while sitting at our desks, have learned enough that it will be capable of sitting in our chairs? So, there are a couple of different challenges. One is how the Trivergence is embraced by society as a whole.

We've got to figure out how to ensure that it doesn't accelerate the trend toward have and have nots. And the other thing it's got to do is to make our lives simpler, more productive and reduce the overall work week. We need to find things that only humans can do that are more interesting and more challenging, even though they may not be as productive. We could leave productivity up to the trivergence as a whole.

The work week itself, at this point, becomes a bit problematic, doesn't it? Because work is becoming so scattered. You're working and doing personal things. You're working at home, you're working on the subway, you're working in the car. There are efforts underway to reduce that. It's the cell phone that has created this nightmare

That was true of my days as a nuclear medicine technician. Those were certainly my beginning days in the technology industry. I really resented that there was simply no concept of having a quiet time to yourself – you could be interrupted anywhere at any time. I think that is an issue that has to be addressed. That's got to come to an end. That's just completely unacceptable. The trivergence offers endless possibilities. Let's ensure the results are broadly beneficial.



Adding Rigor to Sustainability Reporting

By Eric E. Cohen, CPA



Eric E. Cohen, CPA, is a technologist with a passion for collaboration toward the goal that “a piece of business information, once entered into any system, anywhere, never needs to be retyped as it moved through the business reporting supply chain.” He’s also a prolific author, engaged in virtually every effort to standardize accounting and audit data, a national expert to a wide variety of standards efforts, and co-founder of XBRL.

For more than 500 years, the double-entry bookkeeping (DEBK) system has served as a foundation for undergirding financial reporting and associating accounting and reporting information with recording transactions in the business world.¹ Is there any possible analogy to balancing entry methodologies that might be leveraged to develop a system of checks and balances applicable to sustainability reporting?

The fundamental principles of accounting recording, which involve the basic accounting equation ($\text{Assets} = \text{Liabilities} + \text{Equity}$) and the duality concept of offsetting debits and credits, have been an important methodology supporting organizations seeking to maintain accurate and transparent records of their financial performance and position. Much like Newtonian physics and the third law of motion, for accounting entries, "For every action, there is an equal and opposite reaction."

By leveraging the structure and rigor of the traditional accounting system, organizations may be able to establish a standardized and more auditable approach to measuring, recording and reporting their ESG performance.

As society becomes increasingly aware of the importance of environmental, social and governance (ESG) factors, there is a growing need for companies to disclose their non-financial impacts and performance,² for which, at the present time, there is no system with counter-balancing impact. Climate change, in particular, has emerged as a critical issue, with stakeholders demanding greater transparency and accountability from organizations regarding their greenhouse gas emissions and efforts to mitigate their environmental footprint.

This article represents some of the first considerations by the author to explore the potential for adapting the principles of DEBK to create a parallel framework for climate disclosures and other ESG reporting. By leveraging the structure and rigor of the traditional accounting system, organizations may be able to establish a standardized and more auditable approach to measuring, recording and reporting their ESG performance, ultimately enhancing transparency and driving meaningful progress towards sustainability goals.

The Case for a Parallel Framework

The traditional accounting equation and associated DEBK system have proven durable and applicable in supporting the accuracy, completeness, and auditability of financial information. It is not clear if there is a way to support complete and accurate ESG reporting without a parallel framework; with an analogous framework, one that goes beyond a simple list of disclosures, organizations can better achieve comparable levels of reliability and transparency in their non-financial disclosures.

One of the key advantages of adapting the DEBK principles, if possible, lies in the inherent concept of maintaining balance and offsetting entries. Just as financial transactions are recorded as debits and credits to ensure the accounting equation remains balanced, ESG events and impacts could potentially be recorded in a similar manner, such as with "ESG debits" representing positive impacts and "ESG credits" representing negative actions or offsets.



For instance, an organization's greenhouse gas emissions could be recorded as an "ESG credit" in an environmental liability account, while initiatives to reduce emissions or invest in renewable energy could be recorded as "ESG debits" in corresponding offset accounts. This approach not only provides a structured way to track and report on ESG performance but also encourages organizations to actively seek out and implement offsetting measures to balance their negative impacts.

Furthermore, by establishing a parallel framework based on the DEBK system, organizations can leverage the existing infrastructure and expertise in financial accounting to support their ESG reporting efforts. This includes the development of standardized accounts and categories for

various ESG factors, the implementation of auditing and assurance processes, and the integration of ESG reporting with traditional financial reporting for a more holistic view of an organization's performance.

Other researchers have considered how to adapt DEBK to this kind of reporting in specific areas. For example, in biodiversity,³ they identify a closed-loop (“net”) environment, and discuss projects with “net biodiversity impact accounting,” pioneered at a project level, and the impact on statements of biodiversity position and biodiversity performance. The article highlights the need for biodiversity-specific conventions in DEBK; a sustainable and scalable approach likely cannot require broad, specialized conventions. These include the incommensurability of biodiversity components, which means losses in one type of ecosystem or species cannot simply be offset by gains in another. This specificity could be significant in developing reporting standards for other types of environmental impacts, such as those related to climate.

By establishing a parallel framework based on the DEBK system, organizations can leverage the existing infrastructure and expertise in financial accounting to support their ESG reporting efforts.

Adapting the Accounting Equation and Principles

To create a parallel framework for ESG reporting, it is necessary to adapt and expand upon the traditional accounting equation and principles. Here's how this adaptation might unfold:

Redefining the accounting equation itself: Instead of focusing solely on financial assets, liabilities and equity, the accounting equation can be expanded to incorporate non-financial elements related to ESG factors. For example: $ESG\ Assets = ESG\ Liabilities + ESG\ Equity$.

ESG Assets could include intangible assets such as environmental stewardship, social responsibility initiatives and strong governance practices.

ESG Liabilities could encompass an organization's environmental impacts, social obligations and governance risks.

ESG Equity could represent the organization's overall ESG performance and reputation, which can influence stakeholder perceptions and the long-term sustainability of the business.

A challenge here is that the stakeholders may hold very different views of what is positive and what is negative. While, generally, there are some areas that are objectively negative – such as officers being indicted or contributing to an ecological disaster– other areas may be very positive to one group and equally negative to another group, for political, cultural, religious or other reasons.

Developing ESG accounts and categories: Similar to the chart of accounts used in financial accounting, organizations would need to develop specific accounts and categories to track and report ESG performance. These accounts could include:

Environmental Accounts: Greenhouse gas emissions, energy consumption, water usage, waste generation, biodiversity impact, etc.

Social Accounts: Employee diversity and inclusion, labor practices, community engagement, human rights impact, etc.

Governance Accounts: Board composition, ethical conduct, risk management, transparency and disclosure practices, etc.

Establishing ESG transactions, and journal entries: ESG events and impacts would be recorded as transactions, similar to financial transactions in double-entry accounting. These transactions would involve dual entries, with one entry representing the positive impact (debit) and the other representing the negative action or offset (credit). For example:

Credit: Greenhouse Gas Emissions Account Credit: Environmental Liability Account

Debit: Renewable Energy Investment Account Credit: Environmental Offset Account



This process can be separate from other processes, or integrated into existing environments. In fact, some of the existing efforts may naturally be extended for these non-financial measures, as they are simply extensions to what is already recognized. Some examples of process listings/repositories include:

The *US Standard General Ledger (USSGL)*⁴ describes itself as “providing a uniform chart of accounts & technical guidance for standardizing [US] federal agency [governmental] accounting.” In fact, it is much more: it is a collection of standard enterprise processes (transactions) describing perhaps a thousand different kinds of activities, as well as the accounts that are generally relevant to that type of activity. It also provides a “cross-walk” – mappings from accounts to the standard reports line items, and the conditions for the mappings.

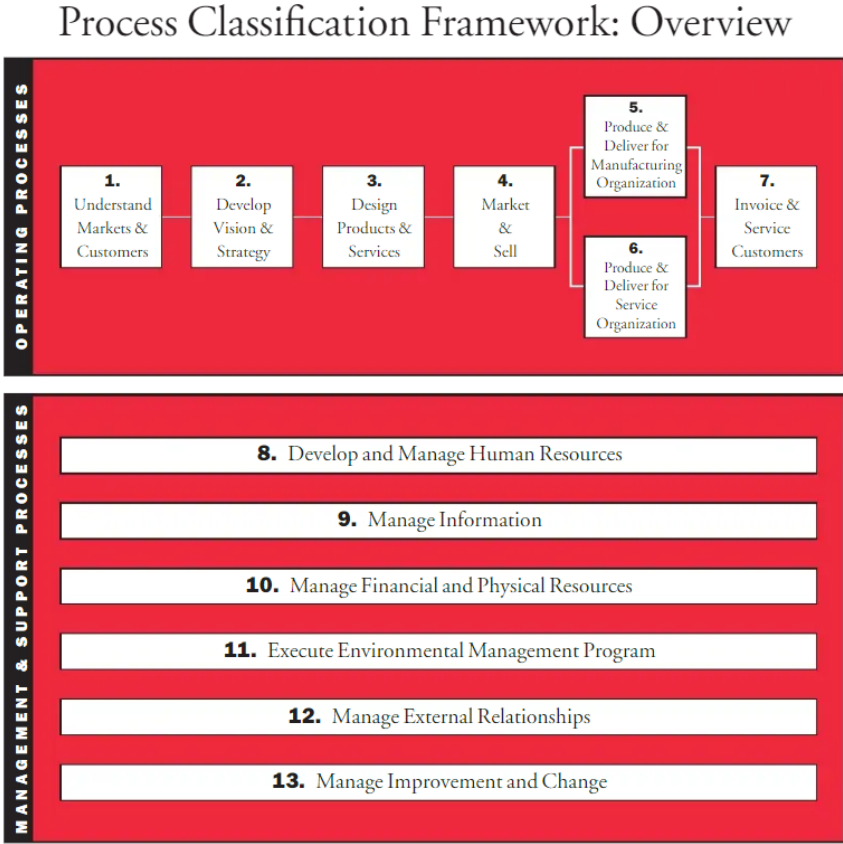
The American Productivity & Quality Center (APQC) has published since 1992 their Process Classification Framework (PCF), currently version 7.3.1.⁵ This mature framework attempts to list all of the key processes performed in an organization, related hierarchically. There is a cross-industry main framework, as well as industry-specific PCFs. PCF was developed in conjunction with Arthur Anderson in the 1990s, and PricewaterhouseCoopers took a leadership role in the early 2000s. In the Figure below, you can see the organization of an earlier version, which specifically included “11. Execute Environmental Management Program.” The most recent PCF instead has “Manage Enterprise Risk, Compliance, Remediation, and Resiliency” as its area 11, and sustainability is listed only in this highest level to “Developer sustainability strategy.”

Maintaining a balanced ESG ledger: The goal would be to maintain a balanced ESG ledger, where the sum of the ESG debits (negative impacts) is offset by the sum of the ESG credits (positive actions). This balance would not only be numerical but would also reflect the organization's real-world progress towards achieving net-zero emissions or improving its overall ESG performance.

Integrating ESG reporting with financial reporting: By adopting a parallel framework based on double-entry principles, organizations can seamlessly integrate their ESG reporting with

traditional financial reporting. This could involve presenting ESG statements alongside financial statements or incorporating ESG information into the notes and disclosures section of annual reports.

Figure 1: Overview of the PCF (source: APQC documentation).



Challenges and Considerations

While adapting the double-entry accounting principles to ESG reporting offers numerous potential benefits, there are also several challenges and considerations to address:

Standardization and consistency: One of the biggest challenges lies in establishing consistent standards and methodologies for measuring, quantifying and reporting ESG performance across different industries and geographic regions. Achieving standardization will require collaboration among organizations, industry associations, regulatory bodies and international standards organizations. It is heartening to see the cooperation between the International Sustainability Standards Board (ISSB), the Global Reporting Initiative (GRI) and the European Financial Reporting Advisory Group (EFRAG).⁶ The Task Force on Climate-related Financial Disclosures has fulfilled its remit and disbanded, and the IFRS Foundation has been asked to take over monitoring the progress of companies’ climate-related disclosures. History has told us, however, that there will be inherent challenges in establishing a universally accepted framework, given the diverse nature of ESG factors and varying priorities and perspectives of different stakeholders.

Assigning monetary values: While financial accounting deals primarily with monetary values, ESG reporting often involves non-financial metrics and qualitative assessments. Assigning monetary values to certain ESG factors, such as environmental impacts or social initiatives, can be subjective and challenging. Developing robust valuation methodologies will be crucial for maintaining the integrity of the ESG accounting framework. As noted, some audiences will find some activities valuable to them, while others will receive the same activities negatively.

Data collection and management: Implementing an ESG accounting system will require organizations to establish robust data collection and management processes to capture accurate and timely information related to their ESG performance. This may involve investing in new technologies, such as advanced data analytics and reporting tools, as well as training personnel to ensure data quality and consistency.

This is one of the areas where XBRL's *Global Ledger Taxonomy Framework*⁷ is uniquely qualified to assist. As a holistic, generic, standardized method of representing the quantitative and qualitative information in a typical Enterprise Resource Planning (ERP) system, XBRL GL is ready to provide a single language for financial and non-financial measures for data integration, data migration, data archival and consolidation processes, as well as mapping (cross-walks, in the USSGL's parlance) to reports.

Developing robust valuation methodologies will be crucial for maintaining the integrity of the ESG accounting framework.

Auditing and assurance: Similar to financial accounting, ESG reporting will require independent auditing and assurance processes to verify the accuracy and reliability of the reported information. This will necessitate the development of auditing standards, guidelines and protocols specific to ESG accounting, as well as the training and certification of auditors in this area. Assurance (or "attestation") is a requirement under both CSRD and the SEC rules, and both regimes begin with a period of "limited" assurance, as "reasonable" assurance will require much more maturity in underlying systems and auditing methods. The SEC rule does not require the GHG emissions attestation service providers to be CPAs, and notes if they are not CPAs, they will not fall under the oversight of the PCAOB or AICPA. One way or the other, critics look forward to answers to the inherent subjectivity and qualitative nature of some ESG factors, which may pose unique challenges for auditors in verifying the accuracy and reliability of reported information.

Regulatory and legal frameworks: As ESG reporting becomes increasingly mandatory in various jurisdictions, there will be a need for robust regulatory and legal frameworks to govern the implementation and enforcement of ESG accounting practices. This may involve the development of new laws, regulations, and disclosure requirements specific to ESG reporting, as well as the establishment of oversight and enforcement mechanisms.

Stakeholder engagement and education: Implementing an ESG accounting framework will require extensive stakeholder engagement and education efforts. Organizations will need to communicate the value and importance of ESG reporting to investors, customers, employees

and other stakeholders, while also providing training and guidance on how to interpret and analyze the reported information.

Conclusion

The adaptation of double-entry accounting principles to create a parallel framework for climate disclosures and other ESG reporting presents a significant opportunity for organizations to enhance transparency, accountability and credibility in their sustainability efforts. By leveraging the structure and rigor of the traditional accounting system, organizations can establish a standardized and auditable approach to measuring, recording and reporting their ESG performance.

While the implementation of such a framework poses challenges related to standardization, data management, auditing and regulatory frameworks, the potential benefits are substantial. A robust ESG accounting system can drive meaningful progress towards sustainability goals, foster stakeholder trust and support informed decision-making by providing reliable and comparable information on an organization's non-financial impacts and performance.

By adapting the principles of double-entry accounting to encompass ESG factors, organizations will enhance their transparency and accountability.

To realize the full potential of this approach, collaboration and collective action will be essential. Organizations, industry associations, standards bodies and regulatory authorities must work together to develop consistent methodologies, establish auditing and assurance processes and create a supportive legal and regulatory environment for ESG accounting and reporting.

Ultimately, by adapting the principles of double-entry accounting to encompass ESG factors, organizations can not only enhance their transparency and accountability, but also contribute to the broader global effort to address critical environmental, social and governance challenges. As the world continues to grapple with issues such as climate change, social inequality and corporate governance failures, the integration of ESG considerations into the core fabric of business reporting and decision making will become increasingly crucial for the long-term sustainability of our planet and society.

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1. Alan Sangster, "The genesis of double entry bookkeeping." *The Accounting Review* 91.1 (2016): 299-315.
 2. Examples include European Union Corporate Sustainability Reporting Directive: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464>; US Securities and Exchange Commission Rule 33-11725, "The Enhancement and Standardization of Climate-Related Disclosures for Investors: <https://www.sec.gov/rules/2022/03/enhancement-and-standardization-climate-related-disclosures-investors>.
 3. Joël Houdet, Helen Ding, Fabien Quétier, Prue Addison, Pravir Deshmukh, *Adapting double-entry bookkeeping to renewable natural capital: An application to corporate net biodiversity impact accounting and disclosure, Ecosystem Services*, Volume 45, 2020, 101104, ISSN 2212-0416, <https://doi.org/10.1016/j.ecoser.2020.101104>. <https://www.sciencedirect.com/science/article/pii/S2212041620300462>.
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<https://www.ifrs.org/news-and-events/news/2023/11/gri-establishes-sustainability-innovation-lab-in-coordination-with-the-ifrs-foundation/>.
 7. <https://specifications.xbrl.org/spec-group-index-xbrl-gl.html>.

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How Will the Updates to OSFI Guidelines B-10 And B-13 Help Financial Institutions Mitigate New Risks?

By Deepak Jaswa, Philip Racco, Geoff Rodrigues and Syed Ali

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Numerous threats are facing financial institutions today — including operational, cybersecurity, technology and third-party risks. Failing to address them can cause business disruptions, legal and financial liabilities or reputational damages to your organization. What steps can you take to successfully mitigate evolving risks in today's financial services landscape?

The Office of the Superintendent of Financial Institutions (OSFI) is at the forefront of trends in the industry, and recently updated its guidelines to help financial institutions address new risks. These guidelines apply to federally regulated financial institutions (FRFIs) — however, they reflect some of the most pressing threats across the financial services industry today. Both federally and provincially regulated financial institutions can benefit from reviewing the updated OSFI guidelines and using those insights to develop a comprehensive risk mitigation strategy.

What are the OSFI guidelines?

OSFI is an independent agency of the Government of Canada with the mandate to regulate and supervise more than 400 financial institutions and 1200 pension plans. It provides oversight and issues guidelines to govern the operations of FRFIs in areas such as risk management and compliance.

OSFI recently updated guideline B-10 for third-party risk management as well as guideline B-13

for cybersecurity and technology risk. It also revised its Technology and Cybersecurity Incident Reporting Advisory and proposed updates to guideline E-21 to mitigate operational risks.

FRFIs must follow these guidelines to appropriately address and mitigate risks to their organization. While provincially regulated financial institutions are not required to align with the OSFI guidelines, regulators such as the Financial Services Regulatory Authority of Ontario (FSRA) has also updated its requirements. Therefore, it may be beneficial for provincially regulated financial institutions to also review these updates and use them to help guide organizational decision-making around risk mitigation.

B-10: Third-party Risk Management

OSFI updated guideline B-10 to expand the definition of a third party to any individual or entity that has a relationship with your financial institution. This may include sponsorships, spokespeople or charities that your organization works with — and will have a significant impact on how your organization identifies, assesses and mitigates third-party risks.

The updates to B-10 also include guidelines to address concentration risk, where your organization relies on the same vendor to provide multiple products or services. The updated guidelines will require your organization to identify and assess concentration risk both before entering an agreement and on an ongoing basis. This will help it determine the appropriate level of mitigation.

Additionally, the updated guideline requires the standardization of contracts to clearly define and manage your financial institution's relationships with third parties.

B-13: Cybersecurity and Technology Risk

OSFI updated guideline B-13 to help FRFIs mitigate cybersecurity and technology risks. These updates introduce new governance requirements to the organizational structure of your IT department — including all operational departments and technology control owners.

The B-13 guideline now also requires your financial institution to establish a clear cybersecurity strategy. This strategy must be aligned with your IT strategy as well as the overall strategy of your organization. It also includes the assessment of third-party vendor risk for outsourced technology and technology processes.

B-13 now requires FRFIs to embed cybersecurity practices within project management and system development lifecycles. Additionally, your organization must provide proper user training for technology, applications and infrastructure under the new guideline. This will help ensure your employees are aware of cyber risks and understand how to address them.

E-21: Operational Risk and Resilience

OSFI also proposed updates to guideline E-21 to include not only operational risk but also operational resilience. These proposed changes are currently available for review and feedback on the OSFI website before the updates are finalized.

If guideline E-21 is updated, your financial institution will not only be required to assess its people, processes and technology to address operational risks — but also to develop a

resiliency strategy. This will include considerations such as the continuity of operations and funds in the case of operational disruptions.

Updates to OSFI Technology and Cybersecurity Incident Reporting Advisory

The updated OSFI guidelines now define a technology or cybersecurity incident as any incident that has an impact — or a potential impact — on the operations of a financial institution. This includes its confidentiality, integrity or the availability of its systems and information. Examples of reportable incidents include cyberattacks, technology failure at a data centre, third-party breaches or extortion threats.

FRFIs must report a technology or cybersecurity incident to OSFI's Technology Risk Division, as well as to their OSFI lead supervisor, within 24 hours under this advisory. Those impacted by a technology or cybersecurity incident are now required to provide regular updates to OSFI as new information becomes available.

The advisory also requires affected financial institutions to provide short-term and long-term remediation actions and plans until the incident is resolved. Additionally, an incident report and lessons learned must be provided to OSFI after the incident is contained.

Is Your Organization Prepared to Mitigate New Risks?

It is critical to take the right steps to address the risks facing financial institutions today to avoid disruptions to your operations and prevent reputational damages. The updated OSFI guidelines can help your organization navigate this new risk landscape and protect it from threats — no matter whether it is a federally or provincially regulated financial institution.

For more information, contact a member of MNP's **Enterprise Risk Services** team at <https://www.mnp.ca/en/services/enterprise-risk>. We have the experience to implement strategies that position your organization for long-term success and are committed to helping you protect your people, your reputation, and your bottom line.



Accounting Makeover using Generative AI

By Jaideep Shah



Jaideep Shah is a software engineer turned product manager with a passion for problem solving and minimizing waste. Jaideep brings a unique blend of breadth and depth across technologies and industries based on his over 3 decades of involvement with building software. Over the years, Jaideep has been at the cusp of new technologies from BPM to XBRL to IOT to RPA, building solutions primarily for the financial and healthcare verticals.

Generative Artificial Intelligence (Generative AI) has emerged as a transformative force across many domains. While its most talked about impact has been that in its revolutionization of chat bots, it has become a valuable asset in software development unlocking unprecedented potential for efficiency and innovation. With advancements like Devin, GitHub Copilot and others in the same vein, Generative AI is reshaping the landscape of coding, promising faster development cycles, higher code coverage in testing, efficient debugging, automated documentation and automated code development. This article advocates for the integration of Generative AI into accounting, auditing and financial reporting software development, highlighting its potential to revolutionize these sectors by streamlining processes, enhancing accuracy, and driving innovation.

A Bit of History

Artificial Intelligence (AI) was conceptualized in the first half of the 20th century more as fiction with entertainment value than a serious scientific endeavor. Back then, if anyone would have claimed robot to be in the realm of possibility, they would certainly have been subject to mockery. By the middle of the century, though, a critical mass of forward-thinking individuals had started giving shape to the utilization of machines to do things intelligently. The grounding of that was based in the fact that humans use information and reasoning to get things done and machines could do the same.

The integration of Generative AI into accounting, auditing and financial reporting software development, has the potential to revolutionize these sectors.

In his 1950 paper, titled *Computing Machinery and Intelligence*, Alan Turing discussed how intelligent machines could be built and their intelligence tested. As the limitations of storage and computing power continued to be removed, the ability for machines to mimic the human cognition continued to rise. Late in the 20th century, AI became a reality, with new approaches to training the machine enabled the machines to get more intelligent. From its humble beginnings as a niche technology to its widespread adoption, AI has overcome numerous barriers along the way. Today, AI has permeated every aspect of our lives, revolutionizing how we work, communicate, and interact with technology.

Almost Limitless Possibilities of Machine Utilization

In late 2022, the release of ChatGPT from OpenAI marked the advent of Generative Artificial Intelligence (Generative AI). Machines had crossed over from simply processing information to now being able to generate information. Generative AI represented the ability of the machines to store and process vast amounts of data coupled with the ability to learn and discern almost independently. For the first time, machines were able to break through a communication threshold that had till now been separating them from humans. With its newfound power of contextualization and generating new data through inference, Generative AI has opened the doors to almost limitless possibilities of machine utilization in areas that have till now required humans.

Generative AI has democratized the process of model building, making it accessible to non-technical users through user-friendly platforms and tools. These platforms empower individuals to create their own AI models without needing a deep understanding of the underlying technology. This democratization has opened up new avenues for innovation and creativity, allowing people from diverse backgrounds to harness the power of AI for their specific needs.



The impact of Generative AI extends far beyond just model building. It has transformed industries ranging from healthcare to finance, enabling organizations to streamline processes, make data-driven decisions and enhance customer experiences. In healthcare, AI-powered solutions are revolutionizing patient care, diagnosis and treatment planning. In finance, AI algorithms are driving automation, risk management and fraud detection.

An area of human domination has been that of software development. Over the years, the tools for software development have gotten richer and smarter, but Generative AI has ushered in a new era of software development, redefining traditional coding practices and unlocking new possibilities. Generative AI tools such as Devin and GitHub Copilot, and others like them, have demonstrated remarkable capabilities, prompting a paradigm shift in how software is created. This article explores the transformative potential of Generative AI specifically within the realms of accounting, auditing,

and financial reporting software development. By leveraging Generative AI, these sectors can streamline processes, enhance accuracy and drive innovation, ultimately leading to more efficient and effective software solutions.

Software Development

In today's dynamic software development landscape, the role of a software developer extends far beyond mere coding. Today's developers are expected to engage in extensive communication and collaboration with various stakeholders, including fellow developers, quality assurance teams, user experience (UX) designers and documentation specialists. Additionally, developers must navigate through a plethora of frameworks, regulations, compliance standards, and security protocols while adhering to core product requirements. This multifaceted nature of modern software development requires effective communication and coordination among team members to ensure that the software meets both technical and non-technical requirements.

As we enter the Generation A (Gen A) era, the integration of generative AI coding assistants or copilots is poised to revolutionize software development practices. These AI tools are designed to assist developers in various aspects of the development lifecycle, from generating code snippets to providing automated testing and verification. By leveraging generative AI, developers can streamline their workflows, improve productivity and address challenges associated with the growing complexity of software development.



Generative AI coding assistants have the potential to enhance collaboration among development teams by automating repetitive tasks and facilitating communication between team members. For example, these tools can help translate user requirements into user stories, generate test cases based on user stories and even suggest optimizations and improvements to existing codebases.

Moreover, generative AI can assist developers in navigating the intricate landscape of frameworks, regulations and compliance standards by providing contextual recommendations and best practices. By incorporating AI into their workflows, developers can stay updated on the latest industry trends

and compliance requirements, ensuring that their software solutions meet the highest standards of quality and security.

By identifying gaps in test coverage early on, teams can address vulnerabilities and weaknesses in software before they escalate into more significant problems.

Backlog Management

In the realm of software development, backlog management is a critical aspect that often requires significant time and effort to ensure that customer requirements are translated into actionable tasks for the development team. Instead of manual effort, Generative AI tools enable the seamless conversion of customer requirements into user stories, saving time and reducing the potential for errors.

One of the key benefits of Generative AI in backlog management is its ability to generate associated epics and themes automatically. This feature allows development teams to quickly identify overarching project goals and priorities, providing a clear roadmap for development efforts. By utilizing appropriate prompts and criteria definitions, Generative AI ensures that the generated epics and themes align closely with the overall project objectives.

Moreover, Generative AI facilitates the creation of sprint and release plans by applying prompts across the pool of backlog items. This interactive approach enables teams to balance issues against available resources, ensuring that deadlines are met and project goals are achieved. Teams can collaborate more effectively, leveraging Generative AI to allocate resources efficiently and prioritize tasks based on their impact and urgency.

Furthermore, Generative AI offers teams a great starting point for backlog management with its speed and ease of use. By automating repetitive tasks and providing intelligent suggestions, Generative AI allows teams to focus their efforts on fine-tuning the plan and addressing more complex challenges. This increased efficiency not only saves time but also enhances the overall quality of the backlog management process.

For example, in accounting software development, customer requirements may include features related to financial statement generation, tax compliance, or internal controls. Generative AI can analyze these requirements and generate user stories that capture the specific functionalities and workflows needed to address them effectively. Moreover, it can identify common themes and epics across different sets of requirements, enabling developers to prioritize and plan their work more efficiently. This could involve mapping out the development of key modules such as accounts payable, receivable, or general ledger, considering dependencies and regulatory requirements.

Enhanced Speed of Development

Generative AI offers unparalleled speed in software development, significantly reducing the time it takes to build and deploy new features. Traditional coding processes often involve lengthy development cycles, but with Generative AI, developers can generate code snippets and prototypes/starter code quickly and efficiently. By analyzing existing code repositories, Generative AI can identify the appropriate sections to include new code snippets, ensuring seamless integration with the existing codebase. Starter code for new features can be developed by Generative AI by being prompted with the associated user stories.

Another powerful advantage provided by Generative AI is its ability to maintain coding style and consistency throughout the codebase. It can ensure that the generated code adheres to the established coding standards, reducing the likelihood of introducing inconsistencies or errors. Refactoring the existing code, optimizing and cleaning it up without disturbing the core logic is another aspect of development that is well served by Generative AI. Developers will be able to focus their maximum time on perfecting the logic rather than worrying about semantics and optimization.



Generative AI would also be instrumental in speeding up the code review processes by not only being able to identify the differences, but also providing an explanation of the change. It allows the developer to query the change for understanding the impact and be directed to suggest alternatives as well. This empowers the developer to assess the validity of the changes more efficiently and accurately. This contributes to overall code quality and helps prevent potential issues from reaching production environments. In accounting software development, for example, implementing new features or addressing regulatory changes often requires extensive coding and testing efforts. With Generative AI, developers can leverage pre-trained models and algorithms to generate code templates tailored to specific requirements. This accelerates the development process and allows teams to iterate on features more rapidly. Additionally, Generative AI can assist in automating repetitive tasks such as data processing and report generation, further improving development efficiency.

Higher Code Coverage in Testing

One of the key challenges in software development is ensuring comprehensive test coverage to identify and address potential issues. Generative AI tools can leverage epics and stories as input to automatically generate extensive test suites, saving valuable time and effort for product owners and engineering leads. Through an interactive interface, stakeholders can seamlessly manage and modify test cases, ensuring alignment with evolving project requirements. The added level of automation and ease of interactively managing the test cases, will enable a higher code coverage ratio in a significantly less time and with drastically less effort.

One of the key benefits of Generative AI is its ability to extract essential aspects of the feature being developed and translate them into detailed test cases. This ensures that all critical functionalities are thoroughly tested, mitigating the risk of overlooking important scenarios. Moreover, Generative AI based tools can assess the efficacy of existing test cases, identifying gaps in coverage and recommending additional tests to achieve comprehensive test coverage. Developers and Quality Engineers can tailor the granularity of their tests to suit specific project needs. Whether it's refining test scenarios to capture nuanced behaviors or incorporating boundary conditions and special cases, the Generative AI based tools provides flexibility and control over the testing process.

Through the appropriate prompts, developers can guide the Generative AI tools to focus on specific areas of interest, ensuring that test cases accurately reflect the intended functionality of the software. Product owners can prioritize test cases based on business requirements, while engineering leads can provide technical insights to refine test scenarios. This collaborative approach ensures that test cases align with both business objectives and technical considerations.

By leveraging advanced artificial intelligence technologies, organizations can ensure that their accounting systems operate efficiently, comply with regulatory requirements and provide reliable financial information for decision-making purposes.

Furthermore, the Generative AI based tools enable proactive identification and resolution of potential issues during the testing phase. By identifying gaps in test coverage early on, teams can address vulnerabilities and weaknesses in the software before they escalate into more significant problems. This proactive approach enhances the overall quality of the software and reduces the likelihood of post-release defects. Through the interactive prompts and explanations, the developers and testers would be made to get deeper understanding of testing best practices and quality assurance principles. This knowledge transfer contributes to skill development and empowers team members to contribute more effectively to the testing process.



In the context of accounting software, this would translate to a more thorough testing of financial calculations, data integrity checks, and regulatory compliance features, leading to more robust and reliable solutions. For auditing software, comprehensive testing is essential to ensure the accuracy and reliability of financial analyses and compliance checks. Generative AI can assist in generating diverse test scenarios covering various edge cases and user interactions, allowing auditors to validate the software's functionality under varying conditions. By achieving higher

code coverage in testing, auditing software can provide greater assurance to stakeholders and regulatory authorities, enhancing trust and confidence in financial reporting processes.

Looking ahead, the evolution of Generative AI technology holds the promise of further enhancements to the entire test case lifecycle. Advances in natural language processing and machine learning algorithms will enable better understanding of complex requirements and generate more sophisticated test cases. By leveraging advanced artificial intelligence technologies, organizations can ensure that their accounting systems operate efficiently, comply with regulatory requirements and provide reliable financial information for decision-making purposes.

Efficient Debugging

Debugging is an essential aspect of software development, often requiring significant time and effort to identify and resolve errors. Generative AI can assist developers in debugging by automatically identifying the root cause of issues and providing relevant code snippets to address them. It can also provide relevant explanations of the conditions that led to the bug. This will immensely reduce the time and effort required of the developer and quality engineer to understand and fix the issue. Moreover, Generative AI can offer up solution code snippets to remedy the problem efficiently, which will further reduce the time and effort needed to fix the issue. This accelerates the debugging process and reduces the likelihood of introducing new errors during the resolution process. In auditing software, for example, automated debugging can help ensure the accuracy of financial analyses and compliance checks, improving overall audit efficiency.

In accounting software development, debugging is particularly challenging due to the complex nature of financial calculations and data processing algorithms. Traditional debugging methods often involve manual inspection of code and data, which can be time-consuming and error-prone. With Generative AI, developers can leverage machine learning algorithms to analyze code and identify potential errors more quickly and accurately. This enables teams to address issues proactively and maintain the integrity of financial data throughout the development process.

Generative AI has transformed industries ranging from healthcare to finance, enabling organizations to streamline processes, make data-driven decisions and enhance customer experiences.

Automated Documentation

Documentation is vital for understanding software functionality, facilitating collaboration among developers, and ensuring regulatory compliance. Generative AI can automate the generation of documentation from code, including release notes, API documentation and user guides. This saves developers valuable time and ensures that documentation remains accurate and up-to-date as the software evolves. In financial reporting software, automated documentation can help auditors and stakeholders understand complex financial models and reporting processes, enhancing transparency and compliance.

In auditing software development, comprehensive documentation is essential to support audit procedures and ensure regulatory compliance. Generative AI can assist in generating detailed documentation of audit processes, including risk assessments, testing procedures and findings. This documentation provides auditors with a clear understanding of the audit scope and objectives, facilitating collaboration and communication among audit teams. Additionally, automated

documentation can help streamline regulatory reporting requirements, reducing the administrative burden on auditors and improving overall audit efficiency.

Improving Efficiency, Accuracy and Innovation

The integration of Generative Artificial Intelligence (Generative AI) into accounting, auditing and financial reporting software development holds immense promise for improving efficiency, accuracy and innovation in these sectors. By leveraging Generative AI tools such as Devin and GitHub Copilot, developers can accelerate development cycles, achieve higher code coverage in testing, streamline debugging processes, automate documentation and enhance code development. As Generative AI continues to evolve and become more pervasive, it has the potential to revolutionize the way software is created and maintained, ultimately leading to more robust, reliable and user-friendly solutions in the accounting and finance industry.

Interesting additional reading:

<i>The History of Artificial Intelligence</i>	https://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/
<i>The Future of Artificial Intelligence and Cybernetics</i>	https://www.technologyreview.com/2016/11/10/156141/the-future-of-artificial-intelligence-and-cybernetics/
<i>Computing Machinery and Intelligence</i>	https://www.csee.umbc.edu/courses/471/papers/turing.pdf
<i>Devin</i>	https://www.cognition-labs.com/introducing-devin
<i>GitHub Copilot</i>	https://github.com/features/copilot





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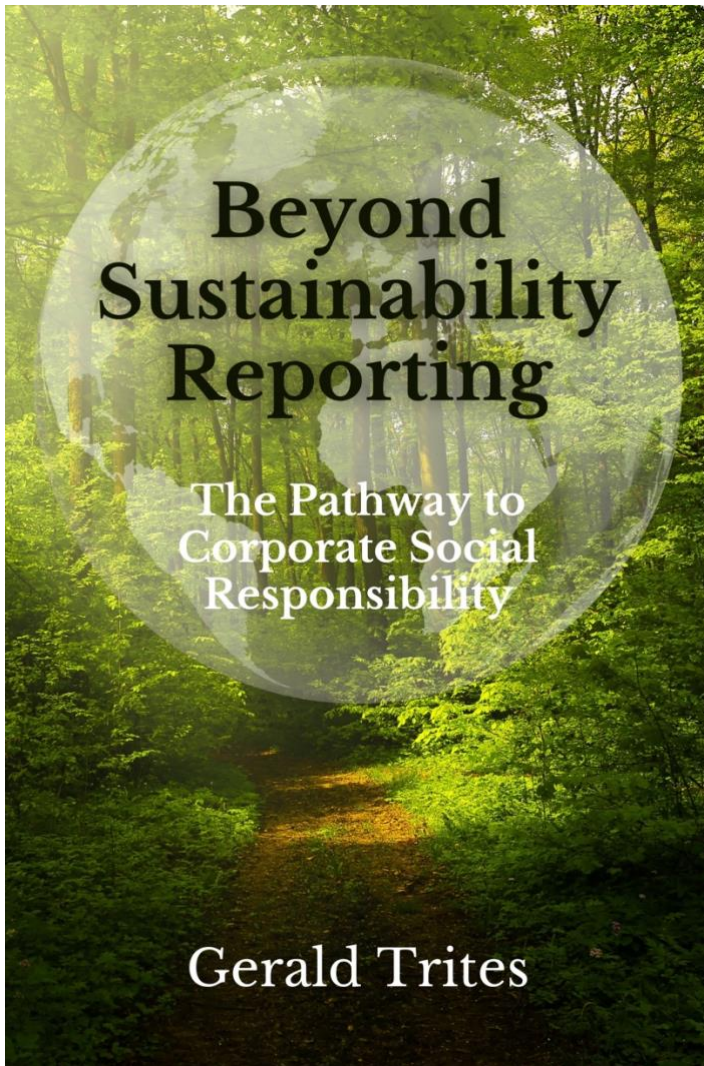
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“Beyond Sustainability Reporting: The Pathway to Corporate Social Responsibility” is a must-read for any companies wanting to make a strong contribution to sustainability issues, for educators who wish to teach sustainability issues and how to manage them, and for any people interested in knowing how companies can develop a strong and successful action-oriented program for sustainability

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How to Convert Sustainability Disclosure into Action

New standards such as those of the International Sustainability Standards Board and new regulations from the Securities and Exchange Commission are challenging companies to increase and improve their disclosure on what they are doing to support sustainability for their Environmental, Social and Governance activities.

Companies are responding by changing their controls and procedures to include sustainability processes. But is this enough? For companies that truly want to help with sustainability issues, the answer is no.

What is needed is the more action-oriented approach laid out in this book, which:

- Enables modifying the corporate strategic plans to include real sustainability actions,
- Makes use of the skills developed in providing sustainability disclosures, such as integrated thinking,
- Includes proper adoption of recognized standards for control procedures recognized by regulatory authorities,
- Adapts traditional management change tools, such as SWOT and the Porter Five Forces Model to include sustainability
- Shows how to move the company from sustainability disclosure to integrated thinking to Corporate Social Responsibility.