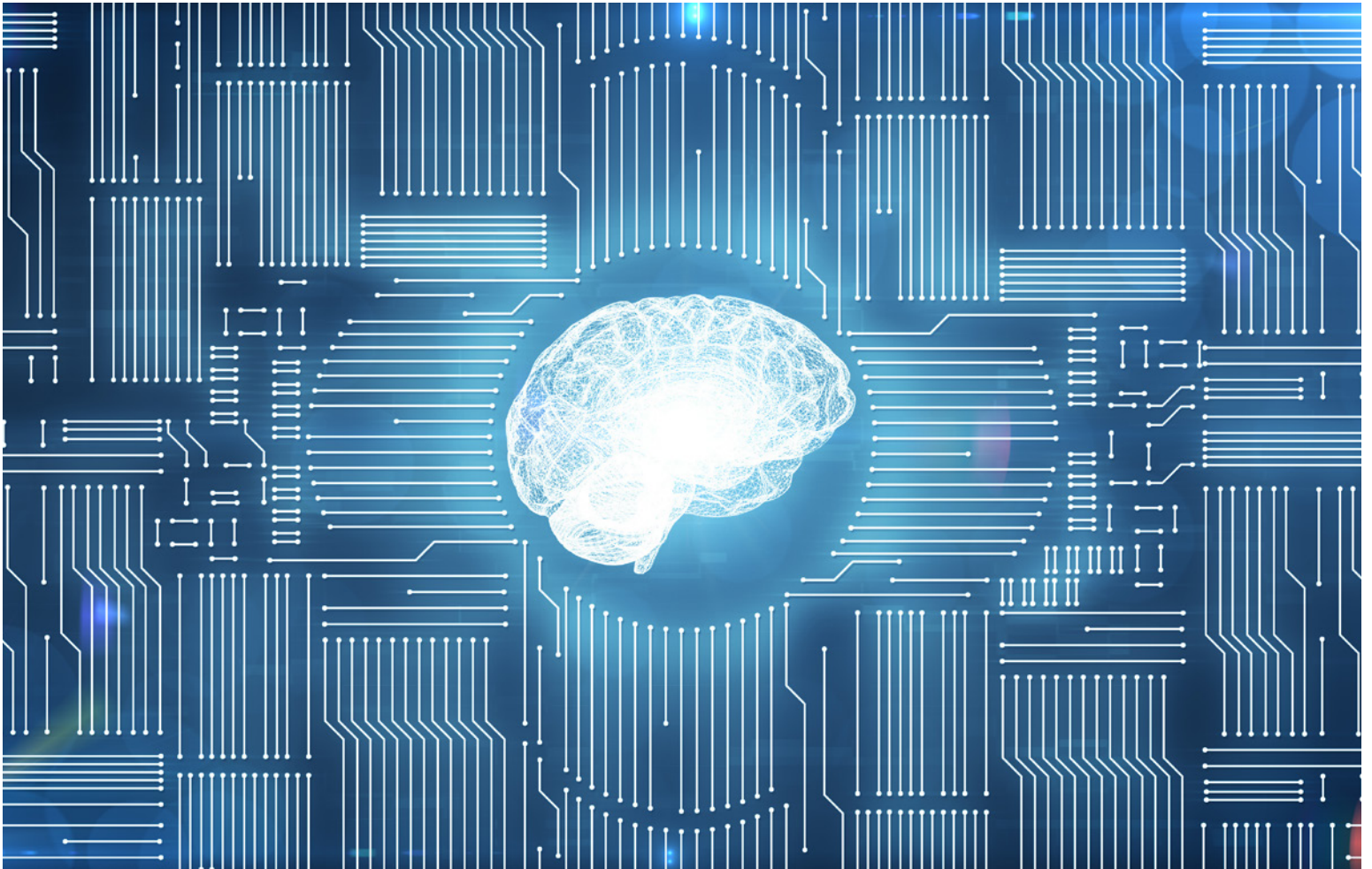# Big Data and Artificial Intelligence—The Future of Accounting and Finance

DISCLAIMER

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Preface

Have you heard the recording of Google Assistant making a restaurant reservation? The Artificial Intelligence (AI) powering the virtual assistant did not miss a beat and made the reservation. Google Assistant, Apple's Siri and Amazon's Alexa are the most obvious examples of how good AI is and how it is becoming a common part of our daily lives.

Of course, it is not just chatbots. All the automated features on new cars that are paving the way for fully autonomous vehicles, smartphone apps that do everything from study your reading habits to update you on the news to placing your Starbucks order, the predictive analytics that retailers such as Amazon are using to tell us what we want/need to buy even before we know it are all powered by AI technologies working tirelessly behind the scenes. And then there are the out-in-the open robots building cars and working as receptionists.

Explosive growth in the volumes of data being created and collected, advancements in computing power and storage, increasingly sophisticated algorithms and rapid advancements in machine learning are all converging to create unprecedented and unimagined possibilities. The result: AI is here to stay, and it is poised to disrupt not just how we live our personal lives but how we work and the broader business landscape as we know it. According to a McKinsey study, up to 800 million jobs could be displaced worldwide by 2030 as a result of automation.[1]

So, what does an AI powered world mean for CPAs? Will robots replace us? Certainly the transactional aspect of accounting and the need to collect and process data are particularly susceptible to automation. Accounting software such as QuickBooks Online, Sage Business Cloud Accounting, and Xero are all leveraging the power of AI to classify transactions from bank and credit card feeds automatically. AI can generate the proper accounting classification of charges to accounts without manual user input.

Still, the short answer is no, AI will not replace CPAs, if CPAs embrace AI and make the most of the opportunities it presents. Most notably, by automating routine tasks, humans will have time to work on different issues. This is a good thing both for business and the profession. For example, a process using automated workflows to book, obtain approval and upload journal entries can then pull in appropriate information to reconcile accounts daily rather than wait until month end. The cyclical nature of financial reporting work will be a thing of the past, giving way to continuous accounting and eliminating insanely busy fiscal year-end deadlines. The benefit of a shift from time spent on data gathering to focusing more on analysis

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1   McKinsey Global Institute. (2017). *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation.* McKinsey Global Institute.

will translate to improved quality and accuracy of financial results. By leveraging technology to streamline accounting tasks instead of spending time on manual and repetitive tasks, CPAs will be able to focus on building and analyzing reports that drive business insights and decisions, securing our role as strategic advisors.

This forward-looking paper is part of a broader conversation CPA Canada is initiating on the potential impact of AI and other technologies on the accounting profession. Specifically, this paper is intended for CPAs in accounting and finance to help them understand the implications of AI technologies, including:

- convergence of Big Data and AI and what it means for CPAs

- new AI technologies and how they will transform the role of the CPA

- future skills needed to succeed in an AI and data-driven world.

For an introduction to AI concepts and terminologies, refer to the CPA Canada and the American Institute of Chartered Professional Accountants (AICPA) joint publication A CPA's Introduction to AI: From Algorithms to Deep Learning, what you need to know.

Please contact us with any feedback or insights that could help us in the development of future publications on this topic.

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How We Got Here: The Intertwining of Big Data and AI

The convergence of the Internet of Things, cloud and mobile computing, and social media has led to exponentially increasing volumes of data being created and collected. Consider these statistics: Google processes more than 40,000 search queries per second.[2] Facebook users send about 31.25M messages and watch 2.77M videos a minute.[3] According to IDC, "by 2020 the digital universe—the data we create and copy annually—will reach 44 zettabytes, or 44 trillion gigabytes.[4]"

Data Lakes and Big Data as a service are emerging to house and analyze large data sets. This all points to what *The Economist* foresaw back in 2010: data would become the new raw material of business.[5] It is also the raw material needed to deliver on the promise of AI, perhaps the biggest and most profound technology shift to impact the accounting profession.

So, what is AI and why is it dominating the business landscape and guiding R&D agendas? The broadest definition describes AI as any task performed by a computer or machine that requires and exhibits human intelligence. The birth of AI has been traced to a research conference held at Dartmouth College in the summer of 1956. Its premise: computers could be taught to think and behave like humans.

Computers need data to learn and the enormous volumes of data now available are poised to deliver on that premise. But not just any data will do. In order for algorithms to engage in human-like decision-making, large, well-maintained quality data sets are required. This need is creating a new opportunity for CPAs.

2   www.internetlivestats.com/google-search-statistics/

3   www.cio.com/article/2915592/social-media/7-staggering-social-media-use-by-the-minute-stats.html#slide2

4   www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm

5   www.economist.com/special-report/2010/02/25/data-data-everywhere

Big Data, Big Opportunities

Big Data refers to data sets that are so voluminous and complex that traditional data processing application software is inadequate to deal with them. IBM data scientists break Big Data down into four dimensions: 1. volume (quantity of data), 2. variety (different sources of data), 3. velocity (the speed of data) and 4. veracity (the uncertainty of data).

Big Data represents a new way of doing business, one where strategy is informed by large volumes of varied sources of data quickly. Businesses not only rely on data within their organizations, they also combine it with data sets from non-traditional information sources to drive new insights. Satellite images of parking lots outside retail stores or auto dealerships, for example, are used to gauge customer volume and inventory turnover, product reviews are used to forecast sales or even potential recalls, and job postings are used to determine whether a company is expanding into a new area. These are all examples of non-traditional data that can be used to provide unique and timely business and financial insights.

The following is an example of how Big Data can benefit even the smallest organization. A butcher shop used small sensors inside its window to track how many people walked past, stopped to look at displays and how many entered. The company learned which displays brought people in and that foot traffic was particularly heavy on Friday and Saturday nights. This unexpected finding led them to extend their hours of operation and drive additional sales.

For CPAs to maintain their role as trusted and value-added business advisors, it will no longer be enough to explain the drivers of revenue variances as just due to a change in sales volume. Reporting and forecasting functions will need to be able to explain the "why" in a more quantitative manner. Was the sales volume lower because the average temperature was lower this winter resulting in less customer traffic to retail stores? Was there a competing online sales event that drew customers away? Explaining the why will not only be important to business partners, but also to savvy equity analysts and investors who are also leveraging Big Data to draw conclusions and use the information to challenge the company's internal assumptions and forecast targets.

The Role of CPAs in Managing and Securing Data

Quality first

A *Harvard Business Review* study noted that only 3% of organizations' data meet basic data quality standards; on average 47% of newly created data records have at least one critical error.[6] At this rate, the number of bad data records can grow very quickly when millions of data records are created everyday. CPAs have a role to play in ensuring the quality of ever-expanding data sets in order to fully leverage the power and advantages of the data around us.

Here are some tactics CPAs can consider to manage data quality:

- Establish clear metrics and targets for data quality (e.g., no more than 1% of records can be incomplete, data error rate less than 5%, etc.).

- Identify data owners and implement controls to ensure accuracy.

- Perform regular reviews on all identified data quality failures and implement changes to prevent recurrence.

- Educate the entire organization on the importance of data quality because everyone has a role to play (from data collectors and inputters on the front lines to data scientists and analysts in the back office).

- Establish consistent and clearly documented procedures for data input, storage, extraction, and analytics.

- Perform regular data quality audits (frequency of these audits would depend on the size and complexity of the organization as well as the quantity of data generated).

For a more in-depth understanding of data management topics, including data preparation, data analytics, and data-driven decision-making, CPA Canada offers an on-demand **Data Management Certificate program** that will cover these concepts in detail.

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6   Nagle, T., Redman, T. C., & Sammon, D. (2017, September 11). *Only 3% of Companies' Data Meets Basic Quality Standards.* Retrieved from *Harvard Business Review*: **https://hbr.org/2017/09/only-3-of-companies-data-meets-basic-quality-standards**

Data Governance, Security, and Privacy

A few key statistics: According to a study by Scalar Decisions Inc., nine out of 10 Canadian businesses suffered at least one cybersecurity breach in 2017. About half of these organiza tions had sensitive data stolen. The annual average cost to recover from breaches is $3.7M.[7] Small and medium sized businesses in Canada are the most vulnerable as these organiza tions often lack the resources to actively monitor for cyber attacks.

CPAs have always been stewards of privacy and confidentiality and have a long history in data assurance and independently evaluating and reporting on controls over information security. As a result, CPAs are well positioned to take the lead on data protection by making recommen dations that help business leaders keep the risks of data breach to a minimum.

To manage and mitigate this potential risk, all organizations must establish a cyber security framework that includes:

• **Identification:** Identify and understand the organization's systems, data, assets, and capabilities.

• **Protection:** Develop and implement safeguards such as access control, awareness and training, data security and backup processes.

• **Detection:** Develop and implement policies and procedures to identify cyber incidents such as requirements for continuous security monitoring and methods to spot suspi- cious events.

• **Response:** Prepare a response plan with corrective action to take in the event of a cyber incident. Include post-mortem analysis of the event for future mitigations and improvements.

• **Recovery:** Recovery procedures to help an organization resume normal business operations.

In addition to establishing an organizational framework, here are some steps CPAs can take to manage data protection:

• Identify sensitive and personal data to manage compliance requirements.

• Remove unnecessary sensitive and personal data to mitigate financial and reputational impact in the event of a data breach.

• Evaluate data retention policies and enforce removal of unnecessary data.

• Ensure data policies and procedures reflect changing regulatory and compliance requirements.

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7   Scalar. (2018, February 08). *The Cyber Security Readiness of Canadian Organizations*. Retrieved from Scalar:
    www.scalar.ca/en/landing/2018-scalar-security-study/

For CPA Canada resources on cyber security, refer to:

- An Introduction to cyber security for CPAs

- Manage cyber security risk and security issues: Questions for directors

- Cyber security: Establishing a risk management program and reassessing disclosure practices

A Brief Introduction to the General Data Protection Regulation (GDPR)

The European Union (EU) enacted one of the world's strictest data-protection law on May 25, 2018. Organizations in breach of GDPR can be fined up to 4% of annual global turnover or €20 Million (whichever is greater). Canadian businesses that meet any one of the following conditions must comply or risk facing fines:

- has offices or employees in the EU

- sells goods and services into the EU online (no physical footprint required, a website or mobile app will do)

- collects Internet Protocol (IP) addresses and personal data of people in the EU to monitor their online behaviour

- processes the personal data of individuals in the EU on behalf of clients.

For more information on navigating these new data privacy regulations, refer to CPA Canada's resource called **GDPR: A Primer for Canadian Businesses.**

New AI and Digital Technologies Will Change the Role of the CPA

AI and digital technologies have the power to create a more efficient and accurate workforce that costs 40% less and can be easily scaled to meet evolving demand. Financial forecast could be automatically updated for daily changes in sales and a course of action recommended to improve the top line and meet growth targets. You might even be able to walk into the office and ask your digital assistant to show you the latest revenue projections by product. Welcome to a world enabled by AI and digital technologies.

AI as a Tool for Business Enablement and Productivity Enhancement
According to a survey by PwC, business leaders believe AI is going to be fundamental in the future with 72% considering AI to be a business advantage.[8] AI will help organizations reduce costs, increase engagement for employees and clients and improve customer service. The impact of AI technologies on business is projected to increase labour productivity by up to 40% and help people make more efficient use of their time.[9] With the emergence of cognitive automation, finance and accounting roles will change. Roles consisting of manual but routine tasks such as bookkeeping, payroll, AR/AP management, and entry-level tax, including middle management roles supervising those staff are at risk of being automated. Financial planning and analysis and financial reporting will experience a shift toward higher-skill positions that focus on translating the underlying analytics to support complex business decisions.

Robotics Process Automation
Robotics Process Automation (RPA) is a set of capabilities of software automation tools that allows users to create their own robots (bots) to handle high-volume, low complexity, and repeatable tasks faster and with more accuracy and lower cost than humans. Typical RPA solutions can provide cost savings ranging from 20%-60% of FTE costs.[10] However, most in-market RPA solutions currently only mimic tasks performed by humans and still

8   PwC. (2017, April). *Bot.Me: A revolutionary partnership.* Retrieved from PwC: **www.pwc.com/us/en/industry/entertainment-media/publications/consumer-intelligence-series/assets/pwc-botme-booklet.pdf**

9   Accenture. (n.d.). *Why Artificial Intelligence Is the Future of Growth.* Retrieved from Accenture: **www.accenture.com/t20170524T055435Z__w__/ca-en/_acnmedia/PDF-52/Accenture-Why-AI-is-the-Future-of-Growth.pdf#zoom=50**

10   EY. (2017). *The dawn of a new partnership - a robotics-led finance function.* Retrieved from **www.ey.com/Publication/vwLUAssets/ey-faas-finance-function-automation-ch/$FILE/ey-faas-finance-function-automation-ch.pdf**

require intensive human programming to set up. While still limited in what it can do, there has been significant progress to marry traditional RPA with machine learning to create cognitive automation that is predictive, self-aware and self-healing.

What could this mean for finance and accounting? A reimagining of entire business processes. For example, a normal consolidation process requires a central team first to collect information and templates manually from various business teams. The central team then reviews the consolidated results and requests follow-up support on significant variances. In addition to automating the manual consolidation, a cognitive RPA solution could access and consolidate the data from the systems used by the various business teams directly instead. This converts the central team function from a reactive, pull-oriented team to a push-oriented and value-added partner. It is still early days, but this is exactly the kind of opportunity CPAs should be planning for and leveraging.

RPA Case Study

Pre-RPA Scenario:

- An organization receives 2,000 daily invoices for processing that require data validation from legacy systems before being posted into the organization's ERP.

- Because integrating the legacy systems with the ERP was cost-prohibitive, the current process was outsourced to a business process outsourcing (BPO) firm.

Post-RPA Scenario:

- RPA bot extracts scanned invoices from a mailbox and places them in a work queue for indexing.

- RPA bot validates invoices by cross-checking invoices against records in legacy systems.

- Pre-set business rules instruct the RPA bot either to post, park, or block the invoice automatically.

Benefits:

- 70%+ cost savings

- 95%+ accuracy rate

- 3-4x faster cycle times

- Improved scalability if volume of invoices spike up or down.

RPA solutions available today are typically separated into three vendor categories:

1. **Enterprise** vendors typically offer the highest sophistication and often require cen
   tralized deployment and higher levels of investment. Examples of enterprise vendors
   include BluePrism and Automation Anywhere, both of which now offer some elements
   of cognitive automation on top of their traditional RPA offerings.

2. **Desktop** vendors are typically used for automating repetitive tasks on independent desk
   tops but do not allow for co-ordination between environments. However, they are usually
   easy to deploy and require lower investment. An example of a desktop vendor would be
   WinAutomation.

3. **Hybrid** vendors fall somewhere in between. They offer a good balance between capa
   bilities and complexity and can be scaled up or down for enterprise use or smaller-scale
   roll outs as required. Examples of hybrid vendors include WorkFusion and UiPath.

RPA Benefits

- greater savings, efficiencies, and benefits than outsourcing

- allows employees to focus on more value-added activities

- improved data quality from reduction in manual errors

- good audit trail

- easily scalable to meet demand

- interacts with enterprise systems the same way a human user would—does
  not require underlying system changes

Considerations

- Be sensitive about fear of job loss.

- Identify potential exceptions and errors where manual intervention may
  be required—RPA is not an error-free operation.

- Review data quality to ensure there are no issues.

- Re-imagine processes first where possible—it is not just about replicating
  existing processes.

- RPA is most effective for processes fully documented and optimized for
  automation (e.g., activities to be performed are standardized and not
  often changed).

- Verify system access for bots as appropriate.

- RPA is most effective with processes that have strong standards
  of documentation.

Advanced analytics

Analytics is not new to CPAs. The finance functions of CPAs already leverage analytics to provide financial insight to their business partners. For example, CPAs in financial report ing roles help businesses understand what impacted their financial results and why. CPAs in financial planning and analysis roles use historical data and assumptions to model and forecast financial results.

Now, with advancements in machine learning algorithms, AI has enabled advanced business analytics. **Predictive analytics** uses data, algorithms, and machine-learning techniques to anticipate future outcomes. **Prescriptive analytics** takes this one step further by guiding predictions into actions (i.e., how can we make it happen). Currently prescriptive analytics is not as mature as predictive analytics, but Gartner estimates the prescriptive analytics software market will reach $1.1 billion by 2019 and 35% of organizations will use some form of prescriptive analytics by 2020.[11]

What does all this mean for CPAs? The role of finance must evolve to do more than report historical key performance indicators (KPI) and make periodic forecasts. Businesses are moving faster than ever before and the speed to insight for finance must accelerate as well. The leveraging of Big Data by advanced analytics solutions can help develop deeper under standing of new market trends, identify new KPIs for performance management, and improve accuracy and timeliness of the forecasting process. "More effective forecasting and a deeper understanding of how markets are likely to evolve can give finance leaders more confidence in their figures, paving the way to better collaboration with other business leaders and increased confidence in the finance team," said Andrej Suskavcevic, CAE, President and CEO of Financial Executives International and Financial Executives Research Foundation.

To adapt to this data-centric world, CPAs will need to develop competencies in information technology that allow them to understand and interact with information systems. There will also be a heavier emphasis on understanding data correlations and trends, which will require solid understanding of statistical methods such as regression analysis, sample-size determina tion, and hypothesis testing. Data contextualization (i.e., knowing what questions to ask about the data) will be as important as performing the actual analytics. A minimal understand ing of coding will become fundamental to most professions, including CPAs. To analyze vast amounts of data, it will no longer be sufficient to leverage tools such as Excel. It will be helpful for CPAs to learn to interact directly with databases via programming languages such as SQL, R, and Python rather than relying purely on data scientists for every request. CPAs will also need to understand how to leverage self-serve data reporting and visualization tools such as IBM Cognos BI, SAP BusinessObjects, Microsoft Power BI, and Tableau to create reports and dashboards to present new insights to management.

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11   Gartner. (2016, February 5). F*orecast Snapshot: Prescriptive Analytics, Worldwide, 2016*. Retrieved from Gartner: **www.gartner.com/doc/3202617/forecast-snapshot-prescriptive-analytics-worldwide**

Advanced Analytics Benefits

- fact and data-driven recommendations and outcomes instead of gut instinct

- support for analyzing vast amounts of internal and external data including real-time events to identify otherwise hidden correlations and trends

- reduction of time to insight and enabling of faster decision-making

- development of deeper understanding of the business and market trends.

Considerations

- size of underlying data sets available; the more limited the data, the less reliable the prescribed outcome

- quality of data; a direct correlation between data quality and reliability of predictive outcomes

- existence of potential bias in underlying data and assumptions that may skew outcomes (e.g., selection bias, sampling bias, modelling bias, etc.)

- availability of qualified data scientists.

Digital assistants

Digital assistants are powered by AI technologies such as natural language processing and have already become a standard feature in most smartphones, tablets, and comput ers. Siri, Google Assistant, and Alexa are the most common examples of AI-enabled digital assistants in our lives. Pew Research Centre reports 46% of Americans use digital voice assistants in their day-to-day personal lives.[12]

The convenience and widespread adoption of digital assistants has resulted in their expansion into enterprise-use cases. Some Enterprise Resource Planning (ERP) vendors have launched their own digital assistants such as "Co-Pilot" from SAP and "Pegg" from Sage. Oracle Cloud provides a platform for enterprises to create their own chatbots and virtual assistants. Micro soft is working on integrating its "Cortana" digital assistant with its Dynamics 365 solution. Smaller organizations that are not using large ERP systems but still want to leverage the power of digital assistants can investigate independent software platforms such as Smartly.ai and Kore.ai to develop their own digital assistants customized for their organization.

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12   Pew Research Centre. (2017, December 8). *Nearly half of Americans use digital voice assistants, mostly on their smartphones*. Retrieved from Pew Research Centre: **www.pewresearch.org/fact-tank/2017/12/12/ nearly-half-of-americans-use-digital-voice-assistants-mostly-on-their-smartphones/**

A Case of Simple Math: Tali—Hands-Free Time Tracking Digital Assistant
The concept of billable time is an important one for accountants. CPAs work hard to provide their clients with value-added advice and services and their time needs to be appropriately compensated.

Assume it takes **30 minutes a week** to track billable time and complete timesheets. Now assume this weekly activity happens **48 times a year on average** (excluding vacation).

If an organization has more than 100 employees, then the organization is estimated to spend over **2,400 hours or 320 working days a year completing timesheets**. Simple math indicates a huge opportunity for time savings.

Enter Tali, a voice activated assistant that enables hands-free time tracking. Tali will increase productivity by tracking time without interrupting the flow of work and integrating with billing systems. Making the chore of time tracking disappear will allow CPAs to focus on providing advice and services to their clients.

As these technologies become more commonplace, digital assistants will complete the more predictable accounting tasks, including responding to common queries around billing and cash flow management (e.g., who owes money, when is it due, how much money is in the bank), and even searching accounting policies and procedures and calling subject matter experts in the organization to get the appropriate information. CPAs will be charged with managing and monitoring these technologies and will have more time to focus on more complex, higher-risk, strategic work.

Digital Assistants Benefits

- always available

- handles simple tasks through fast and easy-to-use conversational speech

- saves time when looking for information

- liberates data—no longer will data owners be the only ones who can answer a query.

Considerations

- Large well-maintained datasets will improve accuracy and usefulness of responses.

- Appropriate data controls must be in place so data queries by unauthorized users will not be returned by the digital assistant.

- A digital assistant is not a substitute for human judgment. If a response does not make sense, then further manual due diligence may be required to verify the accuracy and interpretation of underlying data.

Future Expectations of Accounting and Finance Roles

In the not-too-distant future, artificial intelligence will become so ubiquitous that people will no longer refer to its presence, only its absence. While AI-enabled robots will not replace accountants, they will substantially transform the world. CPAs need to develop new skills and continue to be resilient, adaptive and innovative to remain competitive and help their organizations navigate this transformative and revolutionary technology.

CPAs are in a unique position as business leaders, advisors, board and oversight members to leverage AI to not only build efficiencies but also to maximize Big Data opportunities and insights. This can only happen if CPAs embrace AI and are proactive in enhancing their skillsets to meet the needs of an AI-powered world. They must become digital evangelists within their organizations and build the technological paradigm shift into their organiza tion's strategic and operational plans.

A Glimpse of the Future of Accounting and Finance Roles

The CFO and Financial Planning Leader	The Financial Controller and Accounting Manager	The Shared Service Leader
• Expand data stewardship outside financial data. • Bring together operational data with financial data to drive new data-driven insights. • Leverage data visualization techniques to support decision-making. • Improve timeliness and accuracy of reporting (e.g., real-time forecasts). • Increase focus on managing relationships with stakeholders.	• Enhance governance of financial and non-financial information by using machine learning algorithms to sift through multiple data sets to uncover hidden trends and anomalies. • Shorten financial-close cycles while reducing errors. • Enhance efficiency and quality of processes and controls through automation.	• Increase number and complexity of processes centralized and automated by leveraging intelligent automation tools. • Leverage virtualization and remote work environments along with a global digital workforce to enable 24/7 production schedules.

The Investor Relations Officer	The Equity Analyst
• Predict which investors will have a high probability of adding positions to the company in a 90-days horizon and launch targeted campaigns to encourage investment. • Identify core metrics important to each investor's investment decision by using machine learning to review trade patterns to assess correlation with achievement of certain company fundamental indicators (e.g., ROE above X% or P/E ratio below Y). • Automate creation of customizable, on-the-fly briefing books tailored to individual investors with minimal effort.	• Leverage Big Data analytics and alternative data sources to drive real-time insights and support investment recommendations. • Use RPA solutions to improve time to market of research reports and analysis (e.g., eliminate manual input of company data into proprietary models).

Other Resources and Next Steps

CPA Canada urges CPAs to continue to monitor developments to understand how AI and digital technologies are transforming their businesses. While this publication is a starting point, CPAs should review some of the suggested resources below and are encouraged to explore next steps within their organizations.

Other resources

- Learn more about AI and consider how different AI solutions can help improve and transform business processes:
  - CPA Canada & AICPA Publication—A CPA's Introduction to AI: From Algorithms to Deep Learning, what you need to know
  - CPA Canada—Spotlight on the use of alternative data and AI in investment decision-making
  - CPA Canada Podcast Series—Staying ahead of the disruption curve: Technology Solutions
  - Harvard Business Review—A Simple Tool to Start Making Decisions with the Help of AI
  - PwC Global—Exploiting the AI Revolution
  - McKinsey—How to make AI work for your business
  - McKinsey—What AI can and can't do (yet) for your business
  - IFAC Publication—Why Accountants Must Embrace Machine Learning
  - ICAS Article—How is the accountancy and finance world using artificial intelligence?
- Reflect on ethical considerations around AI solutions:
  - World Economic Forum—Top 9 Ethical Issues in Artificial Intelligence
  - Machine Intelligence Research Institute—The Ethics of Artificial Intelligence
- Understand data management principles and common programming languages used to interact with Big Data sets (e.g., SQL, R, Python):
  - CPA Canada Professional Development—Data Management Certificate Program
  - Journal of Accountancy—Merging Accounting with "big data" science
  - Codecademy Data Science Curriculum—Data Science Path

Next steps

- Explore the Big Data ecosystem in the organization.

- Meet regularly with counterparts in IT to discuss opportunities to leverage new technologies.

- Focus resources around proving the value of AI solutions quickly via a pilot program or proof of concept to build internal consensus.