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The Future Of Accounting And Bookkeeping: Robotic Process Automation And Machine Learning

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The future of accounting is being shaped by the rapid advancement of robotic process automation (RPA) and machine learning. At the same time, many mundane and repetitive tasks are being automated away and the accountancy job more referenced as bookkeepers, clerks and accounting clerks are speculated to be eliminated. Regardless of the growth of complexity in data and business transactions with the rise of new technologies, the automation wave with RPA is not involving such a non-linear processing activity. RPA and machine learning fix an efficiency of managing simple non-unique processes by recreating rules. So far, the basic operational processes of accounting are relatively stable and simple; the related jobs will be massively replaced as companies tend to switch to RPA which reduces the labor cost by sixty to seventy percent. The prediction is based on the financial intuition and observed cases. As opposed to the bookkeeper employment, the middle layer jobs will be minimized. The employees' know-hows of accounting systems will essentially be unnecessary under RPA and machine learning preliminary. With no timing which the future overlord might come, the people in those jobs are expected to take domestic jobs which would render lower income. Moreover, proper roles to be determined in this complex environment arose. One possibility is that accountants can serve to provide judgment based on the accounting data interpretation from certain perspectives since financial data are complex and multi-aspect.

So far, the history of those jobs and their market framework and stage are summarized. The motives and preference of which advanced technologies might be used are demonstrated. Can RPA be a true game changer of accounting? Or will it become a trash obsolete technology like others? A simple pictographic view of the technology life cycle shows different features of RPA versus machine learning. Regarding its own acyclic node of photos and reasoning, the future pictures of RPA and accounting within organizations are displayed. Showing obvious limitations, the machine learning technology could be used to acquire more historical data, improve distribution and deduce or predict the accounting numbers if unregulated.

Keywords: Robots in Accounting, Controlling and Performance Management, Robotic Process Automation and Machine learning, Automation 4.0, Artificial Intelligence, Big Data, Data Management Science, Computer & Hardware, Management Science, Management Information Systems, Management Information Systems & Technology, Robotics, Software & Information Systems.

1. Introduction

Robotic process automation (RPA) refers to a pre-configured software instance, created by IT departments or service providers, which automates business processes, using a defined set of business rules and choreography of activities. Robotic Process Automation is defined as software designed to automate on-screen tasks and is referred to as Digital Labor, Digital Workers or Software Robots through various terminology. In general, RPA works with back office systems to emulate activities performed by humans as part of their job functions. It accomplishes this objective via a deployment of in-house trained robots capable of performing tasks relegated to its design.

A software robot logs into applications in the same way as an employee to collect information from the necessary databases, processes documents and data entry transactions. As built-in automations are low code/no code, software robots can be deployed rapidly at large scale, offering immediate productivity gains, reduced operational costs and freeing up human workforce for more value adding tasks. Across industries, RPA savings potential and the extent of use cases is expected to grow exponentially in the years ahead, yielding larger, more significant operational benefits as compared to traditional and legacy systems of improvement.

Simultaneously, precise and repeatable response times can be achieved, yielding far better service level performance. Increasing use case diversity means that, outside the previously mentioned high-volume processing, RPA is slowly yet steadily making its way into more complex areas of business operations such as investing or compliance. Modeled as a capability rather than a product in itself, RPA implementations require substantially different scoping and a variety of new key success drivers for its deployment. These shifts will allow RPA systems to keep pace with ever increasing business process complexity. Consequently, additional cost and efficiency related business drivers have many associated risks and challenges. With RPA paving the way for definition and implementation of more sophisticated technologies, the question of whether accountants will become obsolete also arises like most other occupations. Technology will surely help excel the work of accountants but interpreted within reasonable limits, they will not become redundant.

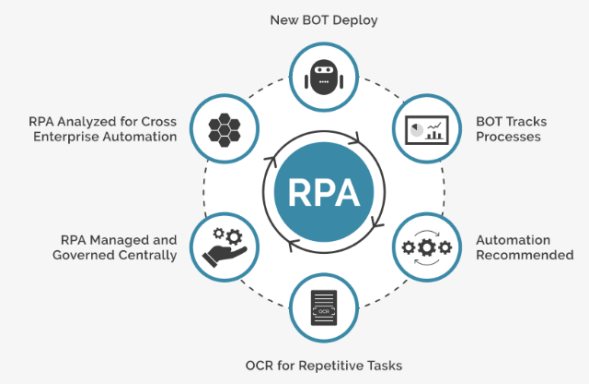

Fig 1: Robotic Process Automation

1.1. Background and significance

As technology continues to rock industries across the globe, accounting and bookkeeping appear to buck up and join the parade. Recent advances in robotic process automation (RPA) systems have fundamentally changed the way seemingly monotonous tasks are performed, creating a need for firms across the spectrum of accounting to evaluate how they can take advantage of such technologies in a cost-affordable way. Stemming from the decidedly information-oriented accounting information systems designs that matured concurrently with the introduction and evolution of the personal computer, firms made massive investments to create networks of financial information. While these systems were, in many ways, radical improvements, their design effectively entrenched traditional ways of working instead of bringing about a realization of the potential for true competitive advantage. Accounting firms are now at a crossroads, as this next wave of productivity-increasing technology is poised to both threaten and enhance current operations.

Incumbents are seeing newer firms rise to disrupt the industry, moving beyond the traditional accounting of events to create prescriptive reporting for bank stress tests, for example. As firms compete for the competitive edge or risk falling behind, it will be critical to anticipate both how to take advantage of the new technologies while also preemptively addressing potential threats. To reduce eating away at revenue-generating labor hours, firms are scrambling to implement fully-automated RPA systems to monitor as well as execute entire processes with little or no human intervention. On the other hand, as RPA systems fundamentally change the dynamics of accounting, bookkeeping operations will be in jeopardy. It is imperative for accountants to universally re-evaluate their strategy and approach to be proactive, rather than reactive. This paper discusses RPA components, applications, pros and cons. A literature review of RPA will be included, along with its future considerations.

Equ 1: Automation Efficiency Equation

$$ATAP = f(RC, FR, DR, CV)$$

Where:

- RC = Repetitiveness of the task
- FR = Frequency of the task
- DR = Degree of Rule-based logic
- CV = Complexity of Variability

2. Overview of Accounting and Bookkeeping

Accounting is a two-part career. The first half of accounting is bookkeeping, which consists of gathering and evaluating financial data from myriad transactions and inputs. This data must be recorded, information edited or adjusted as necessary, and then the data must be presented to management, investors, banks, or governmental agencies. These tasks are easily automated,

and very few jobs exist for purely routine accounting tasks. The second half of accounting is that of accounting. Accounting uses, monitors, and adjusts the data supplied by bookkeeping. It performs far less rote functions since information is often flawed. Innovative inputs can produce valid results that seem erroneous and vice versa. Also, accountancy is often deviational in nature, explaining the why behind differences. This data is often quantitatively transformed but need not be; it can also be qualitative or even rhetorical. In interpretation lies innovation, and it would take centuries for software to replace humans.

Technologies in common usage to various degrees within the accounting field include software. Some use robotic process automation bots or a level of software that automatically captures and enters various data. RPA is sufficiently complex for advanced techniques and items like software tools, automation, and scripts that will aid accountants in their audit tasks. Software cannot perform the duties described in the first paragraph, nor can it substitute for the understanding of accounting advanced principles. This means vast portions of entry-level tasks are ripe for RPA implementation, yet provincial experience cannot be gained quickly in other areas. Furthermore, the nature of entry-level jobs in accounting has not been so inherently human.

Fig 2: Automated Bookkeeping

2.1. Research design

This study seeks to answer the research questions of how selected companies perceive the threat of RPA and ML to accounting in the near term and the extent they have either already implemented new technology in accounting or planning to implement such technology in the near term. Following the methodology of and, four prominent Norwegian accounting firms were interviewed and asked various questions about RPA and ML in accounting. All data were analyzed by the use of qualitative content analysis. The main findings are that, while many companies are about to implement RPA and ML, a major challenge would be the control and supervision of the automated processes. While the task of accounting may decrease, the roles and activities of trainers, educators, and consultants will probably increase. Recommendations are provided for future research with respect to limitations and a suggested research agenda.

The interviewed companies were invited to share their perception of the threats imposed by the new technology. A representative of Company C stressed that intensive manual work performed by clerks will be automated through RPA and ML within 5–10 years. In mid-sized

companies, clerks or operators will be let go as a consequence of RPA and ML, if they are replaced by robotic technology. The respondent thought these forms of automation will not affect the need for skilled professionals who can analyze and evaluate the consequences of the system's output. The changed manner of performing the work and an uncertainty of what tasks that remain have given rise to fears and anxiety. In Company B, which belongs to a large global consulting firm, there is more uncertainty about the future impact, as the success of RPA and ML depends on the customer's capacity to implement these systems and what input data are provided. It was also unclear how competition within the firm could be maintained, if tasks performed by machines could not be priced in such a way that the income matches the costs. At Company A, which provides a range of advisory services to businesses and business owners, it has been regarded throughout the firm that RPA in accounting services should be implemented and that clients with a basic understanding of the business and control should not be left to machines.

3. Technological Advancements in Accounting

Significant technological advances are being observed in business, especially in accounting and bookkeeping practices. Using exponential technologies to automate practice management, auditing, and compliance is becoming common. This big data transformation is bringing the biggest technological revolution for accounting. Currently, computers process vast amounts of data with speed and efficiency. Inputs to computers include accounting documents like transactions, invoices, payroll and tax payment records, financial statements, ledgers, and cash reconciliation documents. Reading documents is an appropriate job for artificial intelligence (AI). Historically, reading was performed by humans with judgment skills and comprehension and image recognition skills. The future of accounting or bookkeeping practices can be sketched through advancements in AI and robotic process automation (RPA). AI refers to technologies that automate decision-based tasks traditionally undertaken by humans. Intelligent agents or systems programmed to perform human-like tasks that usually require human cognition are also referred to as AI. AI takes various forms in practice, such as machine-based learning, data mining, and speech-based technology.

AI has become a buzzword as it is amazing and sometimes scary. Essentially, AI refers to technologies that provide outputs that humans could produce but with speed or capacity that surpasses human efforts. They also improve efficiency and compliance compared to typical human alternatives. However, AI does not replicate human intelligence. As public accounting firms develop and implement AI technologies, understanding the strengths and limits of AI and how humans and computers can work together is essential. Bookkeeping is typically defined as the day-to-day record-keeping component of the financial information system. Data and transactions are captured daily, posted to journals, and summarized to ledgers, all of which are usually performed at the same time in most accounting packages. RPA is most suitable for the straightforward processing of high-volume transactions or periodical compliance tasks where the processes are simple with defined inputs, outputs, and rules.

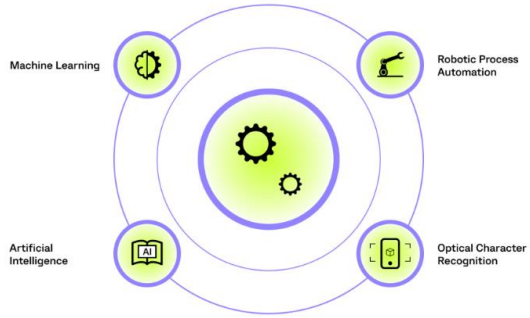

Fig 3: Accounting Technology Trends

3.1. The Role of Technology in Modern Accounting Current disruptions within the profession are driven by technology, and successful firms are embracing it rather than fighting it. An overall analysis of the factors, events, and changes that are shaping the future of accounting and financial services can assist in better providing answers to the question raised. The global accounting and financial services industry is changing. A number of factors trigger this transformation in the profession, such as clients wanting more value-added services, competition, regulations, and technology.

Technology change also impacts the entire client base, and the emergence of a disrupter competing on value or technology can leave firms ill-equipped to continue their traditional service offering. Successful, progressive firms view technological change as a means to improve efficiency and effectiveness, which better positions them to compete in the client market or recruit and retain talent. Measurement and right-sizing of service delivery processes enables a better assessment of the impact or value of the current service offering on the client.

3.2. Historical Perspective on Accounting Technologies Accounting is the practice of how funding is obtained by an organization and how these funds are to be used, and then amassing a portfolio of financial decisions that can be referred to later. Accounting has utilized various information and decision technologies since the beginning of recorded history. In ancient Greece, accounting was called logos, a term which persisted in modern-day words like logic. The Greeks created a language for information systems and their logical processing that has not changed over the years. Much of the basic work of accountants remains unchanged, including the construction of coherency, searching for omissions, and other forms of communication. Double-entry accounting was discovered/tried-invented independently in different civilizations at roughly the same time many centuries ago, in parallel to the invention of writing and the reformation of laws in various funding-concerned civilizations. This technology was adopted by all organizations in these civilizations and the basic technology persists today. Double-entry accounting became the language of accounting for the western world and for many others in Asia and Africa as they became colonized by the western world.

The reformation of a more detail-oriented accounting system slowed and little changed until the renaissance period. In the renaissance period, European mathematicians accrued again and

improved the previous technologies by modifying them for better communication between persons. The printing machine was invented. In parallel, military technology commenced keeping track of inventory and ‘debt-token' structures adopted in China and later in the renaissance by Europe were described, developed and widely used in both military and trading organizations. After these spectacular changes, accounting became detailed and credible enough that individual agents could engage in transactions with others they did not know with trust in their record-keeping.

Equ 2: Cost Reduction through RPA

$$CS = (MH \times CRH) - (RPA_C + IT_OH)$$

Where:

- MH = Manual hours saved
- CRH = Cost rate per hour
- RPA_C = Cost of RPA implementation
- IT_OH = IT overhead for automation

4. Understanding Robotic Process Automation (RPA)

Robotic process automation (RPA) is defined as a software solution that simulates the steps of a process, enhances the interaction between human and computer, and executes sequential repeatable tasks based on certain rules. RPA techniques can be used to code high-level algorithms that can discover inputs and expected outputs in knowledge bases or specifications and automatically generate valid scripts. Robotic process automation (RPA) is defined as a software solution that simulates the steps of a process with predetermined activity sequences and execution location to enhance the interaction between human and computer and executes sequential repeatable tasks based on certain rules. RPA uses business rules and predefined activity choreography to autonomously execute processes across unrelated software systems and employs protocols and event-based trigger mechanisms. The advent of RPA signifies the commencement of an evolutionary transformation that may lead to an irreversible evolution between AI and robots.

RPA is a relatively new business process management solution that allows for easy automation of highly repetitive actions without either the need for programming knowledge or companies investing large amounts of capital in either new hardware or software. Instead, RPA takes data and sends it from one form to another, transforming it along the way. With click-and-drag interfaces, low-code visual drag-and-drop RPA systems allow these changes to be implemented into software known as robotic process automation (RPA) systems. RPA is exempt from traditional expeditionary risk factors. RPA does not completely outmode current cost-effective practices or worldviews as moonshots often do; instead, it requires leveraging current frameworks and complementing these with minor policy changes.

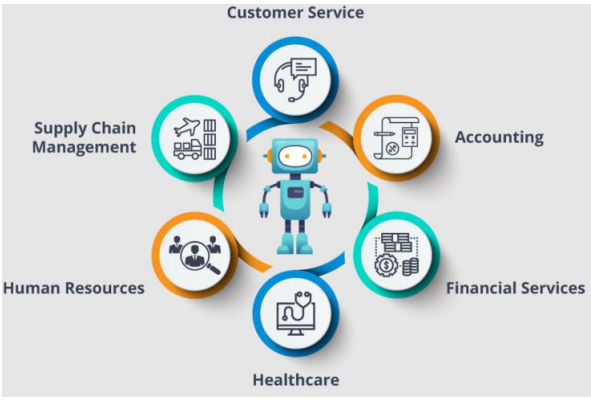

Fig 4: Understanding Robotic Process Automation (RPA)

4.1. Definition and Key Concepts

The term "robotic process automation" (RPA) refers to the technological ability to automate repetitive and often mundane tasks performed by computer applications and human beings. RPA is a version of process automation that uses one or more "robots" (software programs) to eliminate time-consuming tasks. RPA is described as a procedure that uses artificial intelligence and machine learning to handle high-volume data tasks effectively. RPA refers to computer software robots programmed to substitute a human user's physical interaction with a digital system. RPA technology can execute and halt specified actions in a digital system as well as apply business rules to guide the actions that are taken. RPA stands for Robotic Process Automation, and this term has been used since 2012.

The rise of automation technology known as robotic process automation (RPA) is overwhelming the economies of Western nations, because it satisfies the eroding human capital in its availability to process ever-increasing amounts of data. A variety of definitions for RPA can be found in the professional and scientific literature. This variety in definitions demonstrates not only the rapid pace of development of RPA technology and methodologies as well as the introduction of RPA by leading global consulting firms, but also the absence of a consensus regarding terminology. RPA denotes a software robot (RP) which is configured once to simulate one or more human operations. The signage "once" indicates that the robot does not need any further programming as, like a predetermined production line, it is constrained in its actions. The definition of RPA includes both unattended bots focusing on back office processes and attended bots helping front office consultants in their daily tasks.

4.2. Benefits of RPA in Accounting

The most fundamental benefits of RPA technology include speed and efficiency, reliability and accuracy, scalability, cost effectiveness, and ease of use. In accounting, various processes involving more than one application or system can be automated, such as the process of generating recurring reports by gathering data from different databases in various systems and merging it into one report using spreadsheet software. RPA delivers automated solutions to the IT department, to create the software "bots" that simulate human actions. This provides

the accounting department more time to do the more complex work, while cuts require less working hours overall.

Data accuracy is crucial in accounting—little error can cause a huge financial problem. A well-designed bot that simulates a manual action performs the task in the same manner every time and does not miss any steps. In contrast, human work may miss a few steps or overlook detailed verification since humans might be distracted by various issues either on the hardware or personal side. Although the majority of RPA software cannot perform unstructured data processing rationally, they can also clean up the messy data before they feed them to a more intelligent AI algorithm, such as machine learning or deep learning on coded data. This will ensure in advance that the processed data are reliable.

Should the IT department want to onboard scales with additional bots to execute the same automation in parallel, license-trained bots, which are hosted in data centers, can run enterprise bots, when there are no limits on their work. In fact, RPA technology is known for its investment cost. Once the infrastructure has been paid for and the bots hired, the process can run cost effectively with much lower spending [3]. They do not require continuing on-boarding expenses for the maintenance, while human resources do require regular training and salaries.

5. Machine Learning in Accounting

The discipline of accounting, which encompasses the methods and processes of financial resource acquisition, allocation, and management, has recently gained entrance into the age of machine learning (ML). ML is a branch of artificial intelligence (AI) . It is a means by which a computer makes a model from data in order to classify the data or to forecast some property of the data. However, the computer often does not comprehend how it is doing this. Businesses in all lamination are affected by the possibility that some task, previously thought to be viable only for a human, will soon be efficiently and accurately done by a computer.

Machine learning technologies have been developed to assist systems that appear to understand, learn, predict, and adapt. These technologies could operate with little or no human guidance, exceeding the capabilities of traditional rule-based algorithms. The types of tasks these technologies have been designed to accomplish include: classification, clustering, and prediction. The evaluation of items can be accomplished using two approaches. The conventional way is to construct rules based on an understanding of the items. After applying these rules, certain items could be classified and related outcomes could be predicted. The new approach is to provide a machine with data regarding the items. Using this data, the machine could construct the rules on its own. The developed rules could then be used to evaluate additional items.

Machine learning technologies are enabling firms to profit from large data sets without human imposed restrictions on structure and format. Through pre-processing, it allows selection and extraction of features to improve model performance. ML can represent data and learned models in forms conducive to display and business decisions. Outside the business realm, it can detect patterns that were previously unnoticed. Decisions traditionally made by human

experts are now being made by machine learning software. A gasoline distribution company has reduced variance in the size of its trucks and cut costs by $15 million a year by automating timetabling, vessel choice, duration of distribution, truck choice and location of depot. Businesses may get a productivity and accuracy increase as well as substantial cost savings by using machine learning technologies in general.

Fig 5: Machine Learning are Transforming the Accounting Industry

5.1. Introduction to Machine Learning

Machine learning enables computers to learn from large amounts of training data without the need for explicitly programmed instructions for each scenario from that data, enabling behavior similar to human intelligence. Machine learning is a subcategory of artificial intelligence in the same manner that a computer is a subcategory of a calculator device. Artificial intelligence will attempt to simulate human thoughts, reasoning, and cognition. Cybernetics, logic-based systems, or expert systems are common. The most frequently exploited type of machine learning is deemed "statistical learning." Statistical learning employs enormous and complex data to discover principles or models when it cannot grasp performance. Historical data or training data feeds a multitude of techniques seeking a predictive function to describe the data.

Perhaps nothing is more appealing than the notion that computers might learn on their own so companies could concentrate on immensely complicated issues rather than routine tasks. Companies are aware of the machines' potential to dish out statistics or trends on the real-time flow of enormous and complicated data. But many believe there is still destruction in comprehending that capacity. Companies have begun to grasp the significance of it while showcasing opinions on how close they are to making it happen or its possibilities to establish its presence within their data assets that would make a business value. Though, unacquainted machine learning researchers are stuck with a placebo that misguides their focus on inventions or net results while sidelining the importance of business and parting towards overall understanding of a broad range.

5.2. Applications of Machine Learning in Accounting Machine learning is a special type of computational intelligence. Its aim is to develop intelligent systems that can acquire, build upon, or modify knowledge and skills in an experience-based manner. The philosophy behind modern machine learning is to provide the computer with an experience and let it figure it out on its own. Computer programming, data modeling, performance benchmarking, and many other critical issues are still scrutinized as before, but the essential activity is to allow the machine to learn for itself. Supervised learning, unsupervised learning, reinforcement learning,

and semi-supervised learning are the main learning paradigms of machine learning. In supervised learning, a deterministic or probabilistic relationship is learned from the labeled data. Labeled means that the associated values of the desired output are supplied beforehand with the data. Patterns within the data are searched for and derived in unsupervised learning or exploratory data analysis. Often, the possibilities of classification or prediction are limited by what has been anticipated beforehand. Reinforcement learning falls midway in the learning theory framework; coherent knowledge representation, reasoning, and autonomy together can prove weak solutions to real-world applications. Knowledge representation comprises diverse possible techniques and approaches with which knowledge about the world and the inner state of the agent can be built up and constructed in a manageable way. Knowledge representation is too broad of a topic to be covered in this brief overview.

It remains an open question if it will endow ultimate machine intelligence as its proponents dream and maintain the future vision of the field. This investigation is at the intersection of machine learning and computational intelligence. Experts in both domains mostly attend different workshops and forums.

Equ 3: Human Involvement Shift

$$HO = T - A$$

Where:

- T = Total accounting tasks
- A = Tasks automated through RPA/ML

6. Conclusion

Although there currently are vast opportunities for practice growth, the rise of technologies such as robotic process automation (RPA) can also pose significant threats to the practice. Traditionally, advances in technology followed by the large-scale introduction of those advances have had a disruptive impact on applicants. When the computer first gained popularity in the late 1990s, it was predicted to fulfil all steps of the information processing cycle. Thus, the demands for business processes, information systems, information technology, and accountants were expected to flatten entirely. Instead, the professional knowledge worker is now more in demand than ever. As new technologies matured, opportunities for job growth emerged, and consequently, the dilemma of how to adapt outputs, responsibilities, and skill requirements has resurfaced. To tackle modern issues, more emphasis needs to be placed on developing companies that target the array of potential advancements that science continually provides. Currently, it appears that the RPA dilemma has arisen as a disruptor at the same level as a computer in the workplace. This will allow for unprecedented operational excellence, staff movement, and professional growth across industries. As businesses gear up for and plan the implementation of RPA technologies, the designs need to be determined first to avoid unwanted consequences of RPA schemes. RPA solutions are also successful in accounting and auditing firms, though implementation comes with the risk of potential drawbacks.

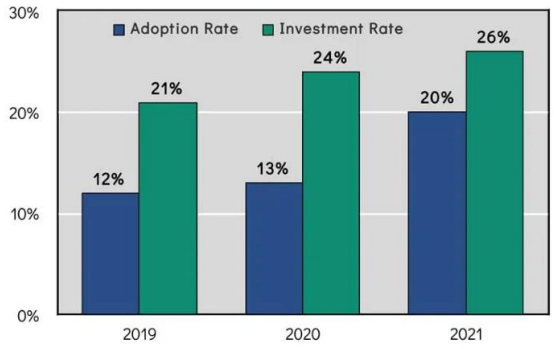

Fig : Robotic Process Automation Adoption Trends and Customer Experience 2021

6.1. Emerging Trends

The global accounting profession is on the precipice of unprecedented change, primarily due to advancements in technology. Big data, blockchain, robotic process automation, and machine learning/artificial intelligence are the four technologies currently dominating the industry. To prepare for these changes, accounting professionals must understand the key issues regarding technology. Careful examination of current trends in technology use is essential to understand how the future of the profession could look through this lens. With respect to these four technologies, what actions are currently taking place? How is the technology being used? To what extent is it being used? Answers to these questions can be uncovered through interviews with top leaders of these firms as well as published literature.

Robotic Process Automation is an actor-structured software that allows programs to fully replicate human actions in the workplace. Bots are trained to process the same steps that the human does and to read the input/output fields/processes of respective systems. Once mid-high-level RPA bots are created, they can be unleashed into the work environment to operate fully auto-magical, taking on full processes that were once human-operated. The magnitude of tasks that RPA bots can automate and are currently automating includes transforming invoices, scanning documents, and even analyzing tax returns. While it is true that many accounting and auditing functions will be fully automated, creating bots for these tasks is often very resource-consuming. Therefore, RPA is being used in a selective fashion, integrating bots with low and medium processes that would benefit from automation.

Machine Learning is a class of AI that is concerned with developing algorithms and techniques that allow computers to learn to comprehend data patterns and generate outputs without having to go through explicit programming stepwise. ML includes the fields of predictive modeling, neural networks, and text mining. Abstracting underlying behavior of hierarchical data out of large data sets has become an enticing idea for large accounting firms to implement. Currently, there are firms developing basic tools to quickly help audit partners review journal entries/other forms of data for high-risk entities or suspicious patterns relying on simple hybrid models but there is yet to be a gold rush on machine learning. Machine learning products have

been developed to investigate tax returns too, as it is easier for a tax preparer to check for misses than creating an analysis of data from scratch.

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