Audit transformation

2021 edition

How will AI change the audit?

pwc

Genial Technology

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1 Introduction

This report contains an assessment of the potential for applying artificial intelligence (AI) in the audit, and an evaluation of the degree of potential impact on audit clients and auditors.

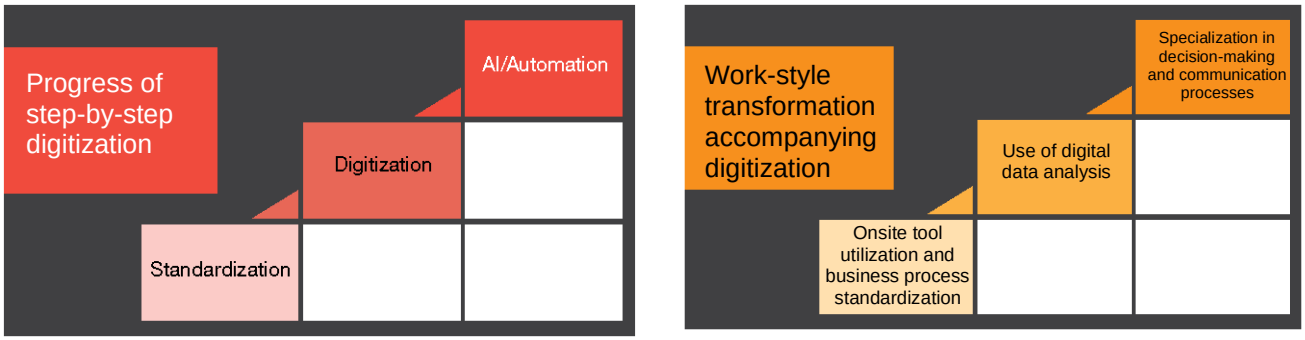
Artificial intelligence has recently drawn great attention with the development of machine learning [1] (e.g., neural networks) and natural language processing [2] (e.g., question answering systems). However, very few AI applications have reached the stage where they can significantly improve the efficiency of key audit processes. The workload associated with audit procedures continues to increase due to new and evolving requirements and regulations, resulting in a surge in demand for high quality process automation to meet stakeholder expectations. Further, the spread of the COVID-19 pandemic in 2020 and thus far in 2021 has prompted companies to adopt remote working practices, which is expected to accelerate the automation of business processes and the digitization of paper documents and audit evidence. For these reasons, auditors are diligently researching and developing AI tools that can digitize audit procedures.

This report is the second edition of *Audit transformation*, which was first published in 2018. This report provides more information on the latest knowledge and understanding of potential uses of AI in the accounting and auditing industry.

1. Machine learning is an element of AI technology which allows a computer to identify a pattern (regularity or rule) in data that would not otherwise be apparent. Computers use this pattern to classify or predict items based on new data.
2. Natural language processing is a technology which allows a computer to process human languages. Natural language processing has already been used in a wide variety of fields including translation, search engines, voice recognition and OCR.

2 Step-by-step digitization: AI implementation processes

Figure 1: Step-by-step progress of audit transformation and the corresponding work-style transformation



Artificial intelligence has the potential to address challenges in manual audit processes including big data sources. However, a large amount of standardized data is required for AI to learn patterns and build algorithms that can perform audit procedures. One challenge with AI technology is that many currently available data sources do not follow a standardised format, which means that they cannot be used for machine learning without pre-processing. This is mainly due to various entities and systems issuing documents in different formats (e.g., sales orders, invoices, shipping documents) Additionally, audit workpaper formats vary depending on various factors, including clients' industries or business processes. In the current audit environment, significant data cleansing and preparation are necessary for building AI models.

Looking to the future of AI-based auditing, three steps must be taken: (1) Standardization of business processes and data; (2) Digitization of audit procedures; and (3) Introduction of AI. Starting with (1), a central office could be set up by auditors to run procedures that do not require accounting judgment, which enables the standardization of operational processes. Alternatively, auditors could use analytics tools to convert data into a consistent format.

The next section describes the specific ways that AI-based technology can be used to automate audit procedures.

3 How can AI be used for audit processes?

Uses of AI for audit procedures

Figure 2 shows some possible ways in which AI could be used after the pre-AI-introduction steps described in the previous section. These use cases include examples of both current and future (post-AI-introduction) audit processes, the quality improvement or time saving benefits for clients and auditors, the rate of replaceability of audit procedures by AI and the expected timeframe for the implementation of future audit procedures.

Figure 2: Examples of AI usage for major audit procedures

	Audit planning			Evaluation of internal controls
	Understanding the entity and its environment	**Risk assessment**	**Audit strategy**	**Evaluation of the status of controls**
Current	• Based on economic conditions and industry knowledge, auditors must gain an understanding of the company and its environment through discussion with management and review of minutes from board of directors meetings.	• Auditors evaluate any business risks that may have affected the business environment and the inherent risks in specific transactions or account balances.	• Auditors determine the extent to which business processes rely on internal controls as part of planning audit comfort.	• Auditors conduct interviews with various individuals from different functions such as sales, accounting, and finance, in order to understand the relevant business processes and internal controls. The auditors document their findings in workpapers.
Future	• AI collects internal information (meeting minutes and discussions with management) and external information (news articles, social network postings and other items concerning the industry) and stores it in a database.	• AI uses the internal and external information on the client's environment gained during the 'understanding the entity and its environment' phase to assess the client's risks, summarise these risks and present the report to the auditor. • AI uses past records of fraudulent activities to analyze the client's finances and identify high-risk areas.	• AI considers the information gained during the 'risk assessment' phase, information from the prior year and any new audit standards to propose an audit plan for each field with sufficient and appropriate audit procedures.	• AI leverages operational data sets through process mining[3] and interviews to provide visualizations of business processes. A tool is used to validate the consistency of these processes against the contents of the interviews and business process narratives.
Benefits	• A database is created consisting of internal and external multilateral information in a standard format. This database will be used for analysis during both audit planning and execution for procedures such as risk assessment and analytical procedures.	• The analysis of all relevant information in real time helps auditors to comprehensively understand the risks of the company and its group. Auditors' uniquely objective evaluation, in conjunction with AI's analytic results, allows for the identification of risks that the client might miss.	• The ability to design the most effective and efficient audit strategy based on the risk assessment makes the audit procedures more focused on risks. This improves the quality of the audit and generates valuable insights that can be provided to the client, subject to independence requirements.	• The creation of network diagrams using process mining, as well as time-series analysis, can be used to facilitate the detection of operational abnormalities and inefficiencies. This may lead to more efficient interviews on business processes and higher rates of detecting internal control deficiencies.
Rate of replacement by AI	Moderate 	Low 	Moderate 	Moderate 
Implementation timeframe	Medium-term 	Medium-term 	Long-term 	Medium-term 

3. Process mining is a technology used for analyzing a business process based on a system's execution log data. Process mining can identify problems in a business process, investigate the cause, and improve business processes by recognizing trends and patterns in the data.

Substantive procedures

Observation	Confirmation	Inspection of supporting documents	Analytical procedures
• Auditors visit the warehouse on the day of the physical inventory observation to reconcile data with the quantity of inventory goods selected as a sample.	• Auditors send confirmation letters to the client's customers to confirm that the balances of a client's Accounts Receivable are matched with those of the customer. Any discrepancy between the answers and the balances is escalated to management for investigation.	• Auditors reconcile samples selected from the sales population with corresponding sales orders, cash receipts and other evidence to confirm that sales transactions are properly recorded.	• Using materials issued by industry associations, historical sales data and previous business results, auditors estimate sales for the current fiscal year.
• AI uses the IoT to link transaction data and inventory item transfers in real time with IC chips and analyzes the data. • AI allows auditors to remotely visit overseas factories and buildings under construction.	• AI confirms balances online and automatically reconciles confirmation letters from customers against the ledgers. It also obtains the breakdown of the confirmation at the same time to automatically reconcile any discrepancy. • AI links with the company's stakeholders to automatically reconcile transaction and balance data.	• AI digitizes sales orders and proof of inspection into electronic files and checks such files against all sales records. • AI reads the articles of contracts to create summaries and identify points to remember during auditing.	• AI uses the internal and external data collected during the 'understanding the entity and its environment' phase to detect abnormalities by validating data consistency and estimating sales.
• The probability of discovering fictitious sales increases. • Physical distance no longer limits opportunities to visit overseas sites. An increase in these opportunities improves audit quality and may reduce the number of hours and the amount of downtime required before the count is completed.	• Accelerated confirmation procedures enable a reduction in time spent by clients and auditors. The significant manual effort for auditors shifts to validating discrepancies during reconciliation. • This process reduces the risk of information security incidents.	• Among the current audit processes, inspection of supporting documents takes a particularly long time. A significant reduction in the time spent on inspection allows auditors to pay more attention to high-risk areas and may reduce the time employees need to prepare, organise, and provide such documents.	• An overall analysis of external data, the company's sales, and other data, together with the validation of this data's consistency, enables the analysis of trends in recorded sales, which cannot be detected from individual transactions.
			
			

The data standardization described in the previous section and the development of an auditing platform that serves as AI infrastructure are key elements for the use of AI for individual audit procedures. Therefore, we also explain the environment in which the AI infrastructure would be built.

Figure 2: Examples of AI usage for major audit procedures (*continued*)

	Substantive procedures		Closing procedures	
	Journal entry testing	**Disclosure check**	**Audit opinion**	**Audit report**
Current	• Auditors review all journal entry data booked in the current year to identify and test transactions that fall under conditions specified by an auditor based on the risk scenarios.	• Auditors use visual examination and reconciliation with supporting documents to confirm that the draft financial statements disclose the necessary information in accordance with the accounting standards.	• Auditors gather all identified audit issues and manually evaluate potential impacts and mutual relationships. Then, the auditor forms an opinion based on the evaluation.	• Auditors report their opinion and discuss Key Audit Matters (KAM) that were identified and audited during the engagement.
Future	• AI identifies trends in fraudulent transactions based on past audit results, and defines abnormalities derived from large amounts of data. Then, it extracts transactions with higher fraud risk, and presents the analysis results.	• Based on the final financial statements and audited materials, AI automatically performs disclosure checks and outputs results. • For unique disclosure items, appropriate disclosure examples are proposed by AI, based on the information obtained from historical disclosure databases.	• For auditor's internal usage, calculate a score based on the client's risk of material misstatements, the number of errors found during audit procedures (and their amounts), and the results of internal control evaluations. Then, automatically evaluate the audit risk and provide information that helps form an audit opinion.	• Generate a draft of KAM based on data collected during the 'audit opinion' phase, as well as historical audit results and KAM descriptions.
Benefits	• It becomes possible to offer insights to the client by combining the auditors' observations on the risk scenarios and specific transactions with higher risk of fraud, detected by AI.	• The time it takes for auditors to perform disclosure checks decreases, and rule-based checking tasks (e.g., calculation checks) become more accurate. • Comparison between the disclosure draft prepared by the client and past disclosure cases becomes easier.	• Quantitative evaluation is added to the traditional qualitative audit opinion. This enables an understanding of objective risks. The comparison of audit risks against other companies becomes easier, which signifies the importance of the auditor's judgment based on the client's specific situation.	• KAM ideas proposed by AI help the auditors improve the quality of the KAM items.
Rate of replacement by AI	Moderate 	High 	Low 	Low 
Implementation timeframe	Short term 	Medium-term 	Long term 	Medium-term 

General (Environment)

Real-time audit	Automatic data extraction	Auditing platform	Standardisation
• Currently, auditors visit the client several times per year, according to the on-site audit plan, to verify their accounting data.	• Because the APIs[4] of most accounting systems are not publicly accessible, automatic data extraction is not commercially available.	• Currently, auditors create electronic workpapers for each client, every fiscal year. Workpapers for each period are not linked in a system, and no auditing platform currently exists.	• Except for some procedures in each field, workpapers are not standardized for most audit procedures.
• AI receives daily accounting data from the client's system and automatically informs auditors of any transaction that requires audit consideration.	• AI receives daily accounting data via the API of the client's accounting system, automatically converts it to the standard format, and links data for analysis in a subsequent process.	• A platform consolidates the client's internal and external data, past audit data and the auditors' knowledge. This aggregates all information regarding the client in one location.	• Journal data, detailed sales data, and other general accounting data (input data) are fed to the system to standardize the analysis output format (workpapers), automating most of the audit procedures.
• Timely data processing and analysis helps detect relevant issues in accounting and auditing, enabling immediate communication.	• Auditors can receive daily client data generated directly from the accounting system, thereby reducing the data provision work of the client's accounting team, and simplifying pre-processing and data analysis for auditors.	• Multilateral client data is consolidated on a platform capable of unified management. These data points can be used for various analyses, AI learning, and improved timeliness, efficiency, and accuracy of audit procedures.	• Standardization of all input data becomes a prerequisite for AI. • Expediting standardization promotes digitization, ultimately leading to the AI-based automation of most procedures. This will contribute to quality improvement and time savings.
High 	High 	Low 	Low 
Long-term 	Short-term 	Medium-term 	Short-term 

4. API (application programming interface) is a method of communication that software can use to exchange data. Installation of an API allows operation of a system's database without direct access to that database.

AI-based automation of audit procedures for individual accounts

The previous section explained how major audit procedures would be automated with AI. This section discusses how AI will change audit procedures for individual accounts.

The risks of material misstatements identified and assessed in audit planning are classified into risks at the entire financial statement level and risks at the assertion level. Assertion-level risks are mainly associated with individual accounts. During the audit, a majority of time is spent addressing risks associated with individual accounts. Due to differences in business process flows, risks and the necessary supporting documents, the audit team assigns an individual auditor to each account. Some accounts (i.e., Revenue and Accounts Receivable) are closely related, in which case the same individual may be assigned. Figure 3 shows the audit procedures for the Cash and Cash Equivalents account as an example. Auditors first receive a complete detailed listing of all cash accounts from the client. Then, they obtain audit evidence through audit procedures. Currently, these types of procedures are performed by CPAs, from the request for data to the execution. Alternatively, a staff member without a CPA license may work on parts of the procedures where accounting judgment is not required.

Figure 4 shows an example of an audit procedure with advanced AI automation. In this example, materials requested from the client are aggregated on the audit platform. Once the materials are uploaded by the client, AI uses OCR [5] to digitize any physical documents. The data is then standardized and fed to an AI analytics tool. For the Cash and Cash Equivalents account, AI will obtain confirmations from financial institutions to compare with internal data, which is the most important procedure for the account. If the AI analytics tool identifies an error, an auditor will further investigate the finding and input the client's responses to the AI tool. The audit evidence is then automatically documented in work papers for the auditors to review.

5. OCR (optical character recognition) is a technology that is used to convert graphical data like handwriting and printed characters into text data. By converting graphical text into text data, OCR provides a way for computers to process visual text.

Figure 3: Current audit procedures for an individual account (Example: Cash and Cash Equivalents)

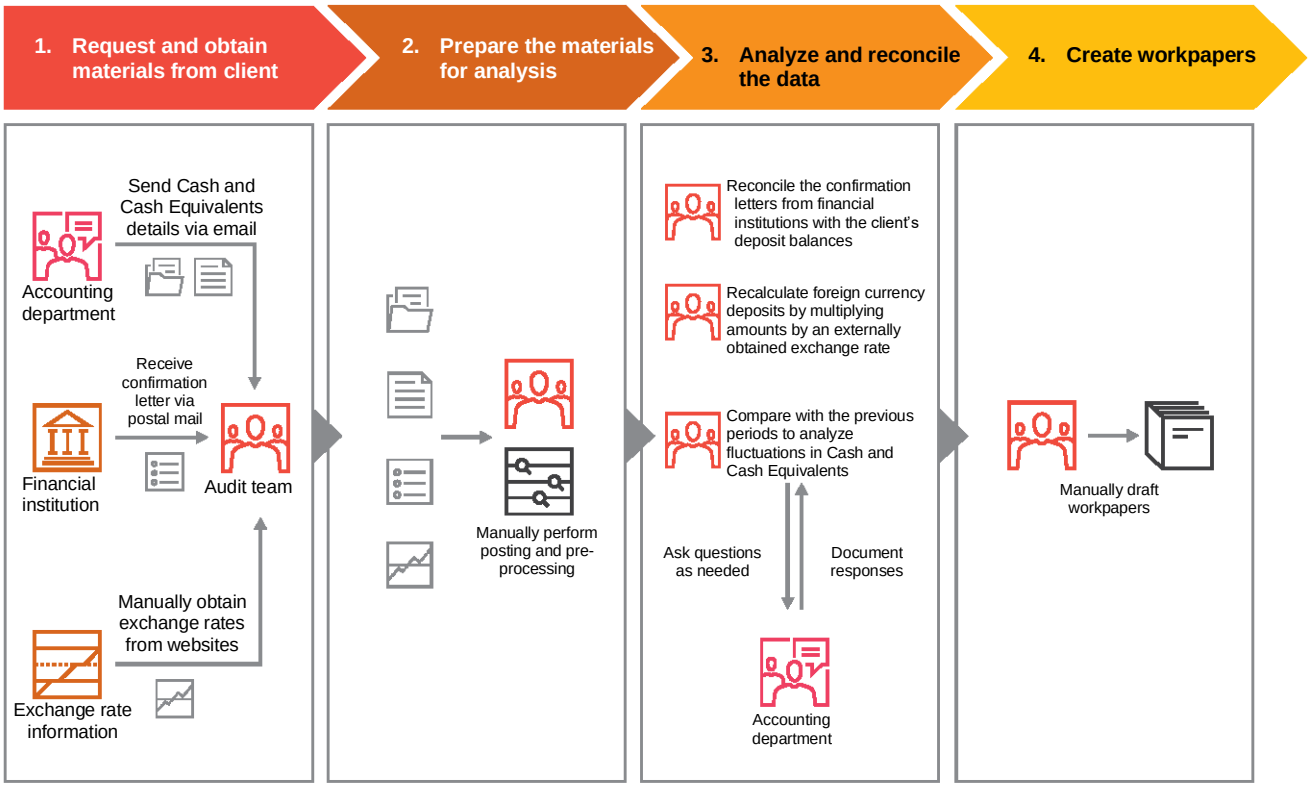
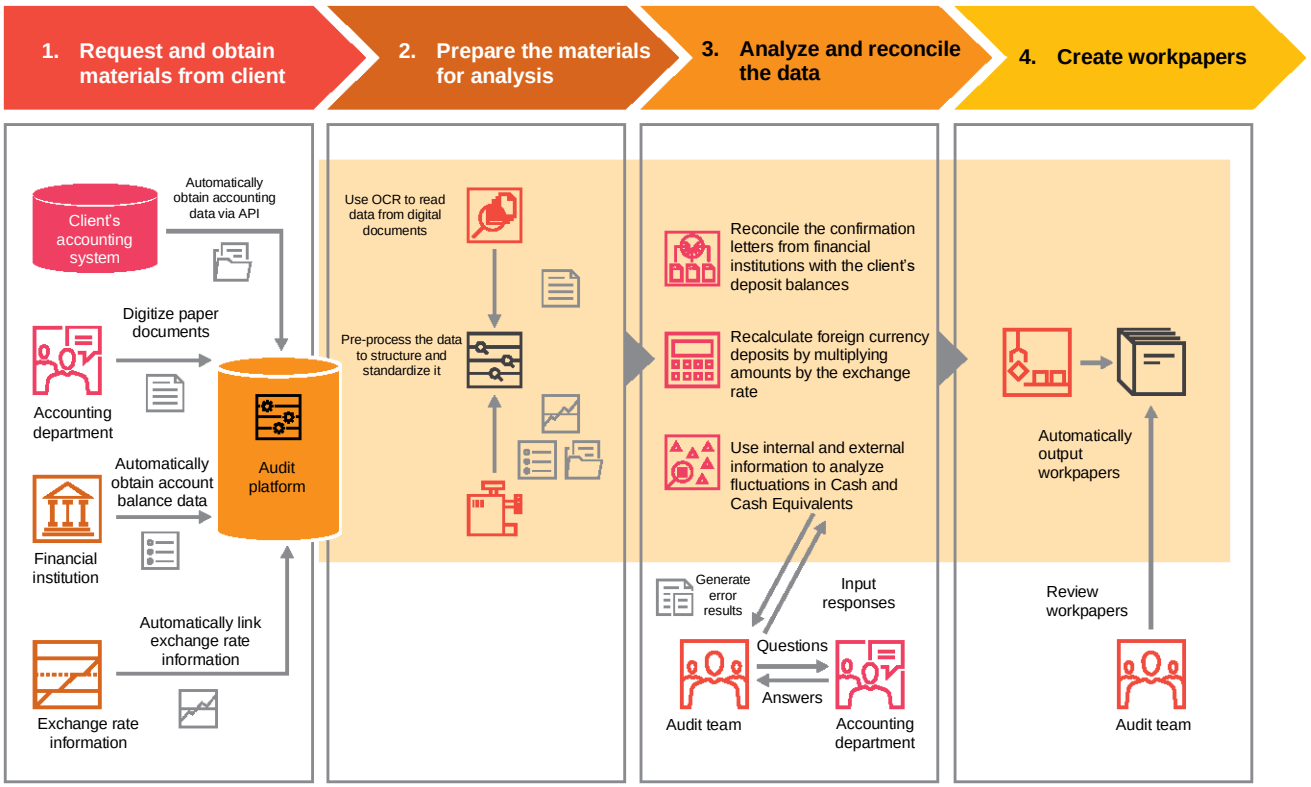


Figure 4: AI-based audit procedures for an individual account (Example: Cash and Cash Equivalents)



Rates of AI-based automation for individual accounts

The previous section explained a use case for AI-based audit procedures for individual accounts. Figure 5 shows the extent to which AI-based automation can be used to supplement current audit procedures for each account.

The 'Hindrance factors for the introduction of AI' section contains three factors: 'Management discretion'; 'Presence of physical assets'; and 'Degree of influence of client's business structure'. 'Management discretion' indicates the the degree of influence of management's subjectivity and discretion, such as accounting estimates. 'Presence of physical assets' indicates the relative amount of physical assets that require verification during an audit, such as products, factory buildings and machinery. 'Degree of influence of client's business structure' factor indicates the possibility that the ability to introduce AI automation in a certain area will depend upon the client company's business structure, (e.g., Sales and Inventory). When these hindrance factors for the introduction of AI are high, it becomes more difficult to introduce AI, which will lower the rate of replacement by AI.

Figure 5: Rate of replacement by AI for audit procedures for individual accounts

Account	Rate of replacement by AI	Hindrance factors for the introduction of AI		
		Management discretion	Presence of physical assets	Degree of influence of client's business structure
Cash and Cash Equivalents	High	Low	Moderate	Low
Accounts Receivable	High	Moderate	Low	Low
Inventory	Low	High	High	High
Fixed Assets	Mid	High	High	Moderate
Accounts Payable	High	Low	Low	Low
Loans Payable	High	Low	Low	Low
Taxes	Mid	High	Low	Low
Net Assets	High	Low	Low	Low
Sales	Mid	High	Moderate	High
Cost of Sales	Mid	Moderate	Moderate	Moderate
Selling and Administrative Expenses	High	Low	Low	Low
…	…	…	…	…
…	…	…	…	…

In spite of the presence of physical assets, the Cash and Cash Equivalents account is not typically influenced by management's subjectivity and discretion, or by the unique structure of the business. For these reasons, we believe that the rate of replacement by AI will be high for this account. Inventory, on the other hand, relies heavily on the knowledge and experience of auditors for various reasons—areas of risk differ depending on the client's business, management's discretion may easily interfere with the account (as can be seen in the valuation loss) and physical assets abound. For this reason, we expect a lower rate of replacement by AI for Inventory than for an account like Cash and Cash Equivalents.

While the rate of replacement by AI depends on the account, not everything can be completed by AI. Auditors must ultimately review the audit evidence obtained by using AI-based audit procedures.

The next section discusses the process of applying AI technology to audit procedures. The section also covers implementation challenges, using supporting document inspection as an example.

Auditors may introduce AI-based audit tools to assist with procedures like inspecting supporting documents and testing journal entries. These procedures offer a relatively straightforward use case for AI solutions that may have a large impact on audits in the near future. Specific examples for each procedure are illustrated below.

Example: Using AI-based tools for the inspection of supporting documents

When testing Revenue, the inspection of supporting documents can include anywhere from a few hundred to more than a thousand samples from sales ledgers that consist of a few million line items. The time to perform a test, and prepare a workpaper for each sample may take approximately 10 to 20 minutes, depending on the complexity of the client company. In aggregate, document inspection requires a significant number of audit hours. We expect the introduction of AI technology to make a substantial impact on this procedure.

Figure 6 presents a flow diagram of the use of an AI audit tool during the inspection of supporting documents.

(1) The AI audit tool reads the related data from the accounting system.
(2) The AI audit tool proposes items to be examined based on the ledger data, the risk evaluation, and the results from prior fiscal years.
(3) An auditor selects samples by using their own judgment, using items proposed by the AI audit tool.
(4) The AI audit tool generates requests to the client via the system for the supporting documents that correspond to the samples selected in (3).
(5) The client arranges the relevant supporting documents and uploads them as electronic files to the AI audit tool.
(6) The AI audit tool identifies the format of the documents and converts them to a format that is compatible with the data in (1). Then, the tool generates test results.

The processes and test results in this flowchart have been simplified to present an overview of the procedure.

Challenges in the development of an AI audit tool

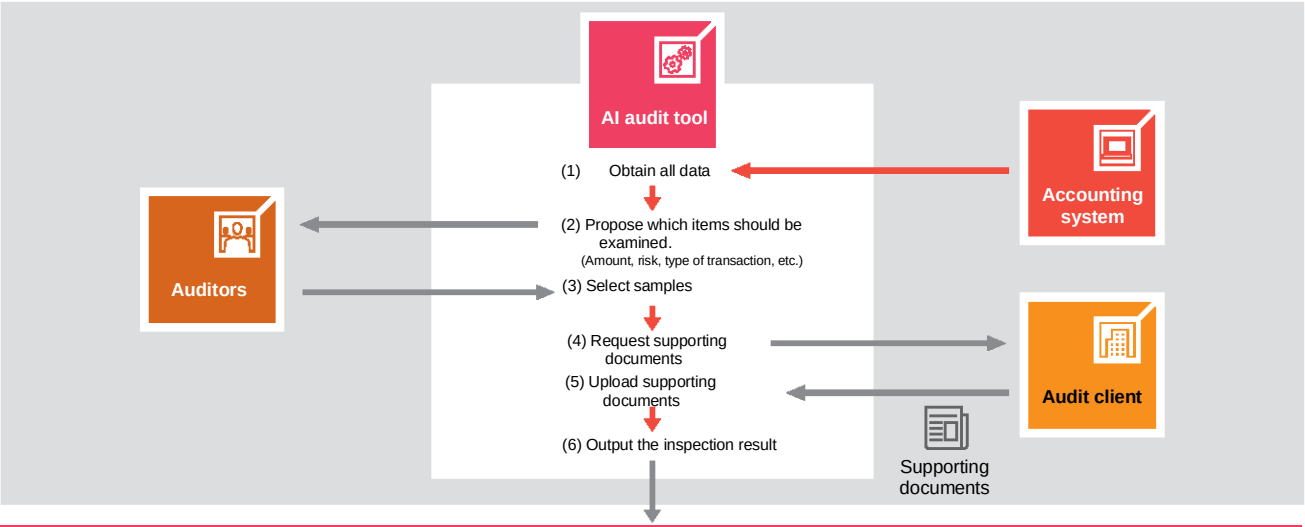
Accuracy in the extraction of the necessary information from supporting document data has been identified as a major concern for introducing AI technology as shown in this use case.

One source of this concern is the amount of informational noise that can appear on supporting documents. For example, a company might add stamps, circles, marker lines, checkmarks and handwritten notes that overlap sections where a key data element needs to be read. Data conversion accuracy would significantly improve if such noise could be removed in advance.

Variation in supporting document formats can also be a challenge for AI technology. One way that AI extracts the correct information from a document is by identifying the coordinates of the desired information, which it will use as a clue when reading the next document that has a similar format. In order for the tool to be effective, the AI tool needs to recognize the format of the document, which can be challenging for procedures where a large number of formats are used. Sales processes, for example, can show significant variation in order document formats from customer to customer.

Clues other than coordinate identification can be used to properly extract information from a document. At this time, further research and development is necessary to support all supporting document formats without preconfiguration.

Figure 6: Flowchart of the inspection of supporting documents using an AI-based audit tool



Sample ID	Date	Amount	Counterpart	Documents are consistent with the amount	Documents are consistent with the date	
000001	1/10	100	Company A	OK	OK	•••
000002	1/21	350	Company B	OK	NG	•••
000003	1/30	200	Company C	OK	OK	•••

The last challenge is extracting key data elements that are used to map accounting system data with supporting document(s). If AI-based audit tools fail to extract key data elements from supporting documentation, the AI-based tool fails all inspections of these documents. Thus, 100% accuracy is required.

For example, a company provided Document (A), which that contained sales amounts and quantities but no key data elements, and auditors were forced to associate transactions with these documents via Document (B). When this method was used, the associating task for (A) had to be done after the associating task of (B).
Another company wrote the key data elements directly on the documents by hand. In this case, the positions of the key data elements had to be automatically detected to accurately read handwritten characters.

The above situations help to illustrate the challenges that AI-based tools can face, including the following: (1) the information necessary for users of a document may be noise to an AI-based audit tool; (2) companies operate with diverse document formats; and (3) special efforts are needed to accurately extract key data elements. This is why the accuracy of document conversion is critical to the success of an AI-based audit tool.

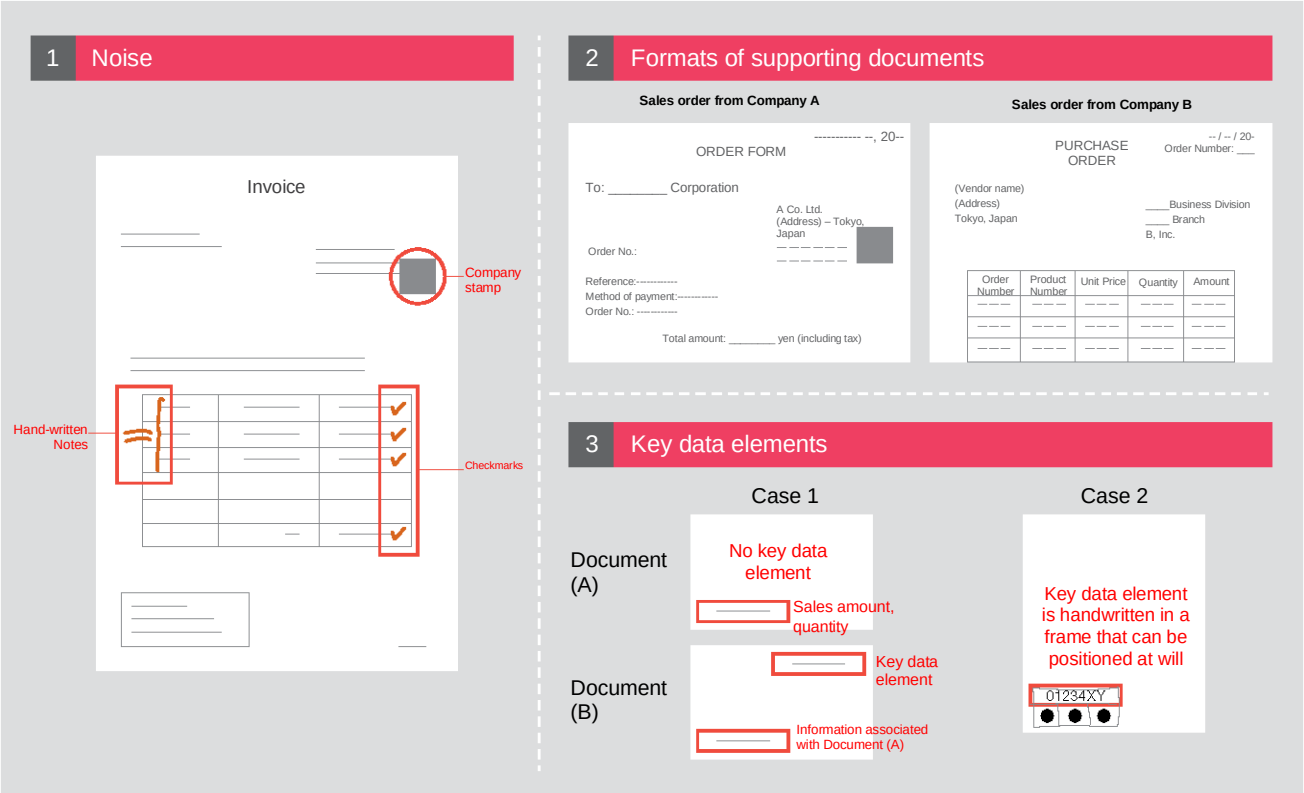
Prospects for AI-based audit tools to inspect supporting documents

To overcome these challenges and teach an AI audit tool to automate the digitization of documents, it is necessary to manually prepare learning data. For this reason, auditors must monitor the test results of the AI audit tool to efficiently improve the tool's accuracy until the precision of the AI audit tool becomes sufficient.

However, if the precision is close to 100%, the auditor can rely on the aforementioned tool. If the audit client is able to maintain all supporting documents as electronic files, depending on the circumstances, an auditor can obtain reasonable assurance by examining all transactions with the AI audit tool, without relying on internal controls. In such cases, an auditor evaluates exceptions identified by the AI audit tool, realigns the configuration of the tool and communicates with the client about the detected items. In the future, it is expected that accurate test results will be obtained for the inspection of supporting documents, such as revenue tests, by leveraging of the AI audit tool and without relying on manual audit processes.

In addition, if the client accidentally uploads old materials or incorrect files, the AI audit tool will generate test results that identify the errors immediately. These corrections can be made by the client, without auditor intervention.
As such, if these challenges can be resolved, the automation of supporting document inspection by an AI audit tool brings huge potential to the transformation of the audit.

Figure 7: Challenges in data format conversion of supporting documents for auditing



4 Summary

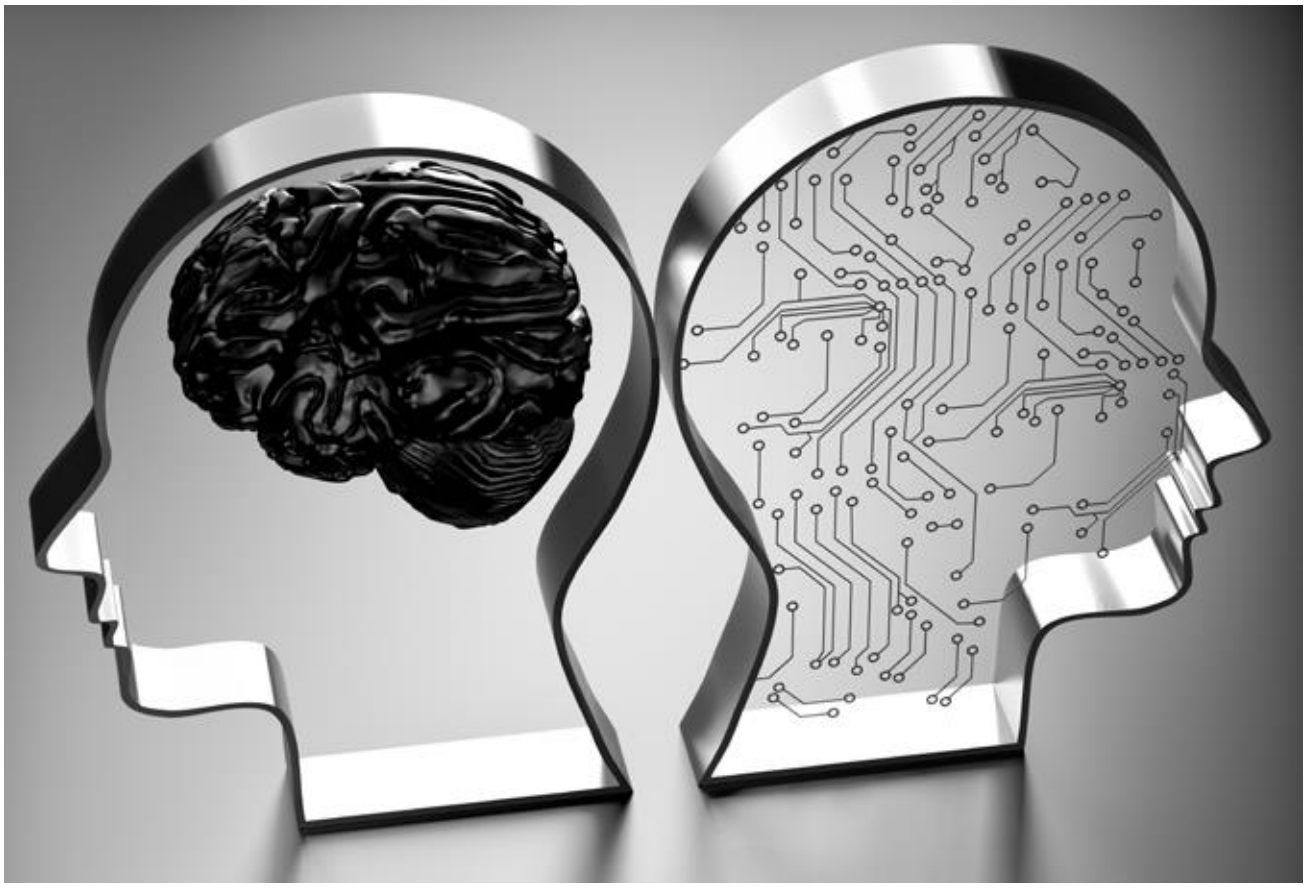
Prospects after the Introduction of AI

Big data started to draw attention in the 2010s, thanks to the advancement of computing and Internet technologies. Now, big data is a familiar term. The advent of big data led to the rise of deep learning, fueling the AI boom. Analysis using big data is now a mainstream technology for managing a business, and the idea of feeding big data into AI tools to identify business opportunities has become commonplace. It is important for companies to own as much data as possible about their business. Additionally, the COVID-19 pandemic is expected to motivate companies who did not previously consider digitization to update their business models. The digitization of society is thus expected to advance further.

In current audit practices, processing and analyzing client data is a time-consuming task that has become one of the root causes of increasing work hours for auditors. Tools that help process and analyze these enormous amounts of data have been introduced to the industry. However, the difficulty of data standardization is an obstacle to the introduction of more AI-based tools. Moreover, we still have not seen a tool that verifies the reliability of data from the viewpoints of data accuracy, completeness, and integrity.

Globally, the amount and importance of company data continues to grow at an exponential rate. The integrity of this data now supports the foundation of a business and its financial reports. If a question arises that casts doubt on the reliability of this data, it would have a grave impact on the company itself, so assurance of data reliability is also crucial from the perspective of corporate governance.

Artificial intelligence is expected to help objectively guarantee the reliability of company data, although the current technology has not reached a sufficient level. As AI-based technologies mature, the scope of the audit will expand beyond traditional assurance engagements, such as the financial statement audit, to real-time risk response procedures, communications with clients and the predictive audit. Auditors will leverage their know-how of the audit and AI to engage in a wide variety of tasks regarding the reliability of data and business processes. Assurance of client data shapes the assurance of the entire company, beyond financial reports. This will be achieved through a combination of advanced AI and the auditors' knowledge and experience.



Overview of PricewaterhouseCoopers Aarata LLC and Genial Technology, Inc.

By enhancing its IT utilization and collaborating with the member firms of the PwC global network in 155 countries around the world, PricewaterhouseCoopers Aarata LLC (PwC Aarata) aims to deliver higher quality, more efficient auditing services. By considering the roles of both humans and technology, PwC Aarata is continuously exploring the next generation of audit services.

Genial Technology offers software for automating audit procedures, including accounting data cleansing and the exchange of audit documents between an auditor and its client, using technologies like cloud computing and AI.

The missions of PwC Aarata and Genial Technology are complementary. The two firms share a common interest in collaborating on identifying trends and conducting research in the field of audit technology. PwC Aarata offers a broad range of expertise in audit practice, and Genial Technology provides expertise in data cleansing, analysis, and AI model development.

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