

# *Audit Transformation*

How will AI change the Audit?



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# 1. Introduction

This report considers the application of artificial intelligence (“AI”) to auditing.

AI is an approach to develop human-like intelligence on a computer, and it has recently drawn great attention with the development of machine learning<sup>1</sup> (e.g., neural network) and natural language processing<sup>2</sup> (e.g., question and answer system). AI technology is not new; it has been studied for decades. However, the application to auditing is still in its infancy.

AI’s key audit transformation technologies are machine learning, natural language processing and automation. These technologies may enable task automation and support decision-making, which is expected to significantly enhance audit effectiveness and efficiency. However, AI is merely a tool to help auditors solve problems and cannot define audit challenges alone. Accordingly, it is important to carefully identify the challenges to apply these technologies.

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<sup>1</sup> Machine learning is one of the AI fields and a technology which allows a computer to automatically identify a pattern (regularity or rule) hidden in data. Computers use this pattern to classify or predict items based on new data.

<sup>2</sup> Natural language processing means a technology which allows a computer to process natural languages that people usually use. Natural language processing has already been used in a wide variety of fields including translation, search engine, voice recognition and OCR.





## 2. How will the Audit transform?

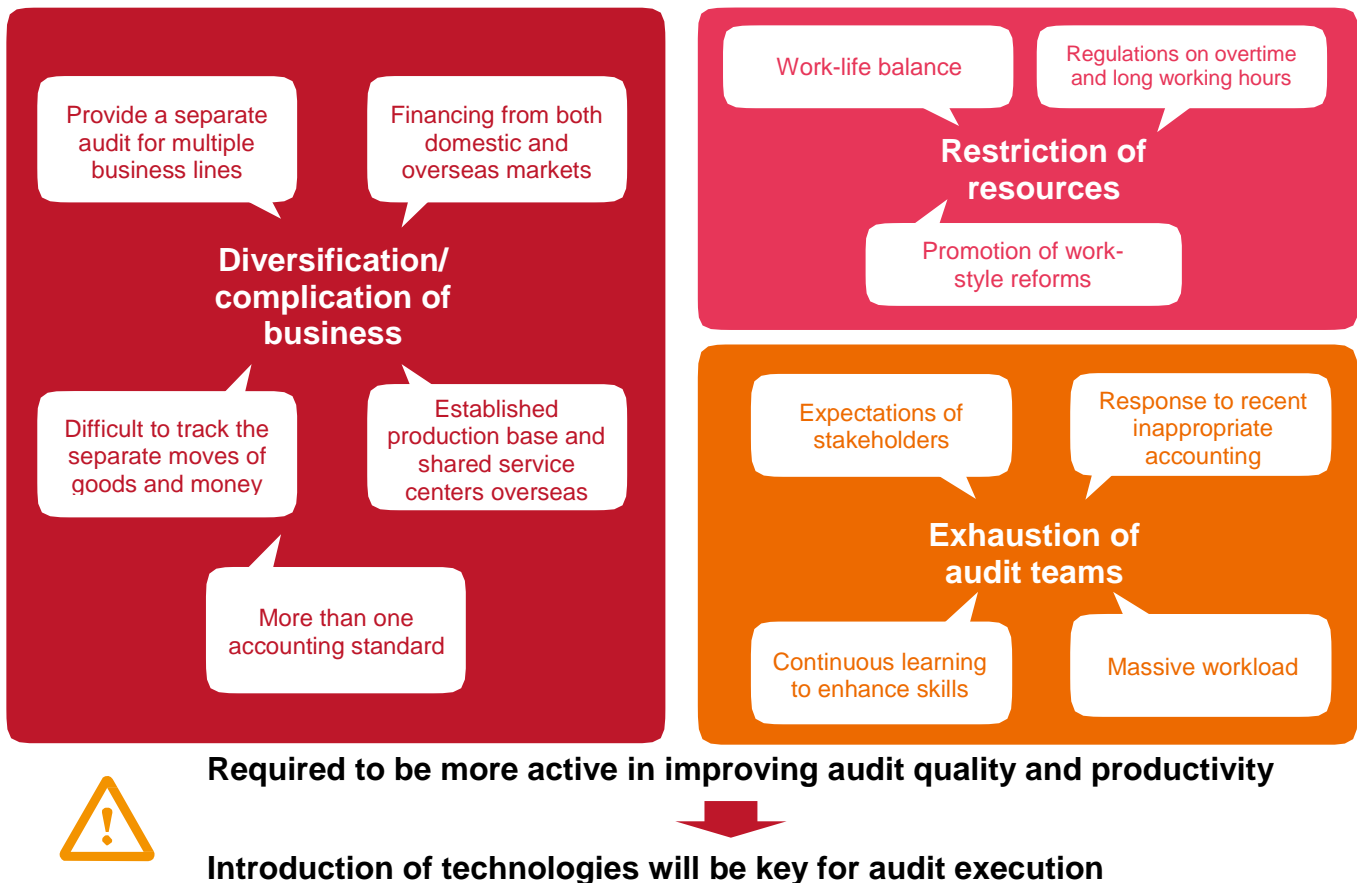
### Challenges surrounding the Audit and the possibilities of technology

Following a series of corporate scandals in Japan, investors and society have been focusing on the role of auditors; raising expectations considerably, which surpassed the current audit requirements. Meanwhile, companies have become increasingly diversified and complex; expanding the scope of the audit. Accordingly, the workload of the audit team has increased significantly over the last decade. In line with the promotion of work-style reforms in Japan, the enhancement of audit efficiency has become an urgent matter to improve long working hours. An increase in quality and productivity is a major challenge for today's auditors to meet the expectations of stakeholders (Figure 1).

Currently, a significant component of audit procedures has been conducted by accountants. Although they are trained to effectively make professional judgement, many procedures do not require the ability. Accordingly, the introduction of technologies such as RPA<sup>3</sup> and AI can automate work to reduce the workload. This will allow accountants to focus on other works that require professional judgment. Introducing these technologies may enforce business standardization and monetary and labor costs. However, automation also may allow accountants to specialize which will lead to enhancing both the quality and productivity of audit. Thus, the introduction of technologies will be a key for business solutions on auditing.

<sup>3</sup> RPA (Robotic Process Automation) means approaches and software that automate simple tasks in indirect operations. By repeating procedures based on preconfigured rules, software enables to judge displayed contents and input data on behalf of humans.

Figure 1: Challenges facing auditors



### ***Prospect after the introduction of AI***

Companies have faced fundamental changes due to the introduction of new technology including incorporation of RPA and AI into their operations. The technologies introduced by companies will impact audit risk assessment and/or audit scope.

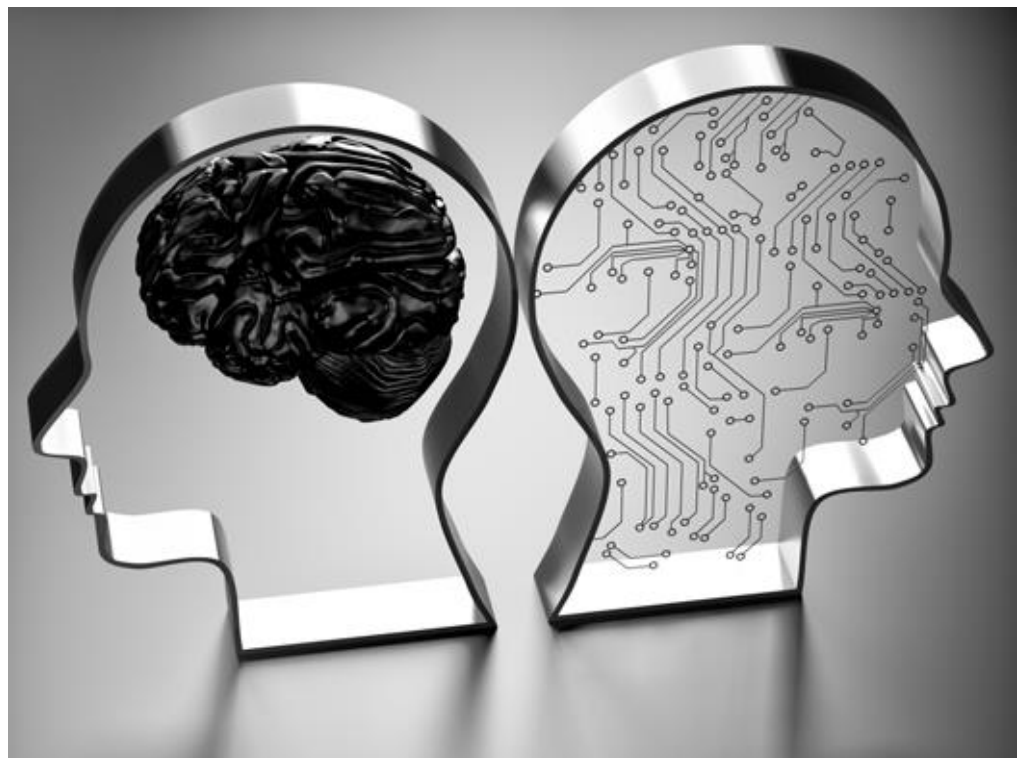
In the future, the advanced systems managed by companies and auditors will be linked to one another and AI will provide automated and real-time audit assistance. As AI timely detects accounting issues, the key role of auditors will be to resolve issues and communicate with their clients. Auditors will have to possess not only the audit insights, but also the capabilities to understand and manage technologies.

Currently, audit fees are generally derived by aggregating working hours of auditors. Due to the introduction of technology, however, future audit

fees will be focusing more on advanced risk assessment and quality of the procedures to respond to the risks. In addition, under the new and revised Auditor Reporting standards<sup>4</sup> which is expected to be implemented in Japan, an audit report is highly likely to contain the risk of material misstatements assessed with AI and the result of responses to the risk that investors can objectively evaluate the quality of an audit provided by each auditor. Therefore, auditors who provide more highly value-added audits will more effectively meet the expectations of stakeholders.

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<sup>4</sup> In Japan, discussion about “Transparency of audit report” has started, and it is being discussed that audit risks and responses to the risks should be described in an audit report as “Key Audit Matter (KAM)” in addition to the opinion expressed for the appropriateness of financial statements. This aims at raising the communication value of the audit report and increases transparency for investors, analysts and other users



# 3. What are the AI use cases for the Audit?

## Use of AI to audit procedures

Auditors identify and assess the risk of material misstatements in their client's financial statements and identify significant accounts and disclosures. Based on these results, auditors perform audit procedures on a

statistical basis in principle, a method of drawing samples from a population and obtaining sufficient and reasonable evidence. Auditors express their opinion about the financial statements of their audit clients based on the evidence obtained.

**Figure 2: Examples of the AI usage to major audit procedures**















































































Audit process	Example of current audit procedures	Example of future AI audit	Necessary technology	Maturity	Complexity	Impact	
Audit planning	Understanding of company 	On the premise of economic conditions and industry knowledge, understand the company and its environment through discussion with management and review of minutes of the Board Director meetings.	Summarize discussion with management through voice recognition and create minutes automatically. Check the minutes with other information to prepare audit work papers automatically.	 Voice recognition  Natural language processing	Medium 	High 	Small 
	Risk assessment 	Evaluate the business risks that may have affected the business environment and the inherent risks in specific transactions or account balances.	Automatically prepare a risk assessment report based on work papers in prior years, business environment and industry trends, and preliminarily identify risks for auditor evaluation.	 Natural language processing  Machine learning	Low 	Medium 	Medium 
	Audit strategy 	Determine the extent of internal control reliance for business processes.	Based on the business understanding, risk assessment and prior audit information, intelligently propose the level of reliance on internal controls.	 Natural language processing  Machine learning	Medium 	Medium 	Medium 
Evaluation of internal controls	Evaluation of implementation 	Interview with persons in charge of sales administration, accounting and finance about sales process to understand business process and internal control, and then describe the details in work papers.	Automatically prepare the minutes of interview to people in charge through voice recognition. Based on the minutes, self-generate work papers, including business flowcharts and risk/control matrices, and visualize the business process to analyze quantitatively.	 Voice recognition  Machine learning	Low 	High 	Large 
	Operation test 	The person in charge of accounting in a client processes the payment for expenses and another person approves the payments. An auditor reviews the results of the above procedures and validates the effectiveness of control.	Scrutinize the expense payments supporting documentation, and automatically judge the adequacy of the approval.	 Natural language processing /OCR  Machine learning	Medium 	Medium 	Medium 
Substantive procedures	Observation 	Auditors visit a warehouse on the date of a physical inventory, reconciling data with the quantity of inventory goods selected as a sample.	Use a drone to count inventories and identify barcodes, and then reconcile the result with inventory data.	 Drone  3D scan  Natural language processing /OCR	Low 	High 	Medium 
	Confirmation 	Send confirmation letters to client's customers to confirm that the balances of client's accounts receivable are matched with those of customers. Any discrepancy between the answers and the balances is raised to management for investigation	Through an online platform, send and receive confirmation letters to/from customers and the auditor. Reconcile the balances of client's accounts receivable with those of customers and identify the reasons for any discrepancy.	 Encryption	High 	Medium 	Medium 

Figure 2 presents the results of our evaluation on required technology, maturity, complexity and potential impact on audits regarding the use of AI in key audit procedures with specific examples.

	Audit process	Example of current audit procedures	Example of future AI audit	Necessary technology	Maturity	Complexity	Impact
Substantive procedures	Inspection of supporting documents	Reconcile samples selected from the sales breakdown with corresponding sales orders, cash receipts and other evidence to confirm that sales transactions are properly recorded.	Import sales orders, cash receipts and other evidence as electronic files, and automatically reconcile them with the sales breakdown to identify any differences.	 Natural language processing  Machine learning	High 	High 	Large 
	Analytical procedures	Consider materials issued by industry associations, historical sales data and previous business results, auditors estimate sales in the current fiscal year.	Automatically import external data, such as market trends, competitors' movements and feeds from video cameras and sensors, then estimate sales amount.	 Machine learning  IoT	Medium 	Medium 	Medium 
	Journal entry testing	Review all journal entry data booked in the current year to identify transactions that fall under conditions specified by an auditor as a potential fraud transaction.	Identify suspicious transactions showing unusual patterns from all subledger and peripheral systems in addition to the journal entry data.	 Machine learning	High 	Medium 	Large 
	Disclosure check	Confirm that the draft financial statements disclose necessary information in accordance with the accounting standards by visual examination and reconciliation with supporting documents.	Input the draft financial statements and supporting documents, and systematically perform a disclosure completeness check.	 Natural language processing /OCR	Medium 	High 	Large 
Closing procedures	Audit opinion	Gather all identified audit issues and manually evaluate potential impacts and mutual relationships. Then, form an audit opinion based on the evaluation.	Calculate a score from client's risk of material misstatements, the number of errors in the audit procedures and their potential effect, and automatically evaluate the audit risk.	 Natural language processing /OCR  Machine learning	Medium 	High 	Medium 
	Audit report	Form conclusions based on the format of the audit standard.	Based on the expression of the opinion, automatically summarize audit procedures against the risk of material misstatements and the evaluation results for "Key Audit Matter (KAM)" to make a draft.	 Natural language processing /OCR	Medium 	Medium 	Medium 
General	Audit room	Borrow a meeting room from the audit client to reside in from a few weeks to few months.	Establish an audit room in virtual 3D space, which an auditor in a remote location can use to communicate with other team members and client personnel.	 VR (virtual reality)	High 	Medium 	Medium 
	Timing of audit	Visit the client according to a field audit plan to confirm that the transactions and account balance are appropriately recorded. If auditors cannot schedule the time, in some cases they may not verify material transactions promptly.	Receive daily data from the client's system and automatically inform an auditor of any transaction that requires audit consideration.	 Machine learning  Natural language processing	High 	Medium 	Large 

Auditors may introduce AI audit tools for inspection of supporting documents and journal entry testing. These are relatively easy to use AI solutions that may have a large impact on audits in the near future. Specific examples for each test are illustrated below.

**Example: application of AI for the inspection of supporting documents**

Regarding annual revenue tests, depending on the scale and complexity of the client, an auditor may, in some cases, examine a few hundred or more than a thousand samples from sales ledgers that consists of a few million line items. If it takes about 10 to 20 minutes for each sample to be selected, perform a test, and prepare a work paper, it requires a significant amount of audit hours. Accordingly, the introduction of AI to this procedure is expected to generate a potent effect.

Figure 3 presents a flow diagram when an AI audit tool is introduced for 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, risk evaluation and the results in prior fiscal years.
- ③ With reference to items proposed by the AI audit tool, an auditor selects samples by his/her own judgment.
- ④ The AI audit tool asks the client by e-mail for the supporting documents corresponding to the samples selected in ③.
- ⑤ The client arranges relevant supporting documents and uploads them as electronic files to the AI audit tool.

- ⑥ The AI audit tool generates the test results.

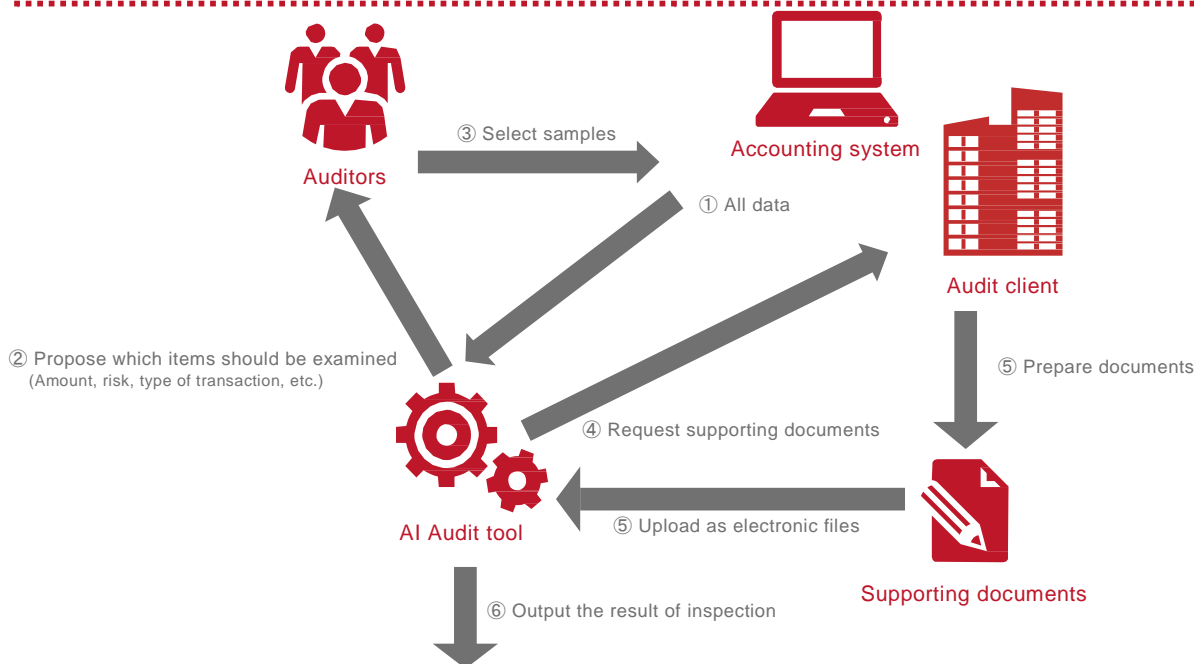
Each process and test results are simplified to show a general approach.

By using the AI audit tool above, the test results are presented immediately after supporting documents are uploaded. The AI can detect if the client uploads obsolete documents or a wrong file by error. Accordingly, the client can correct the mistake without the intervention of an auditor.

Auditors must monitor the test results of the AI audit tool 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 is expected to obtain the necessary level of reasonable assurance by examining all transactions with the AI audit tool, without relying on internal control. In such case, an auditor evaluates exceptions identified by the AI audit tool, realigns the configuration of the tool and communicates with the client about the matters that require to be followed up.

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.

**Figure 3: Flow of inspection of supporting documents using AI 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	✓	✓	...
000002	1/21	350	Company B	✓	✗	...
000003	1/30	200	Company C	✓	✓	...



## Example: application of AI for journal entry testing

Journal entry testing is an example of a procedure to respond to fraud risk in the current auditing standards. In journal entry testing, an auditor defines a set of criteria to extract journal entries for testing. Proactively using a wider range of data, including subledgers and external system data, may enable auditors to perform more detailed testing and define criteria more precisely.

Figure 4 presents a flow diagram when an AI audit tool is introduced in journal entry testing.

- ① The AI audit tool reads transaction data from the accounting system by importing data from the general ledger, subledgers and customer/vendor master. Depending on the fraud scenario that an auditor assumes, the tool may obtain data from other systems in addition to the accounting system.
- ② The auditor selects a test method based on the fraud scenario assumed. The test method includes the extraction of data under specified conditions, summation of data for each category, reconciliation of multiple data, and detection of outliers using a calculation model.
- ③ The auditor confirms the test results of the AI audit tool and judges how such a result should be evaluated.

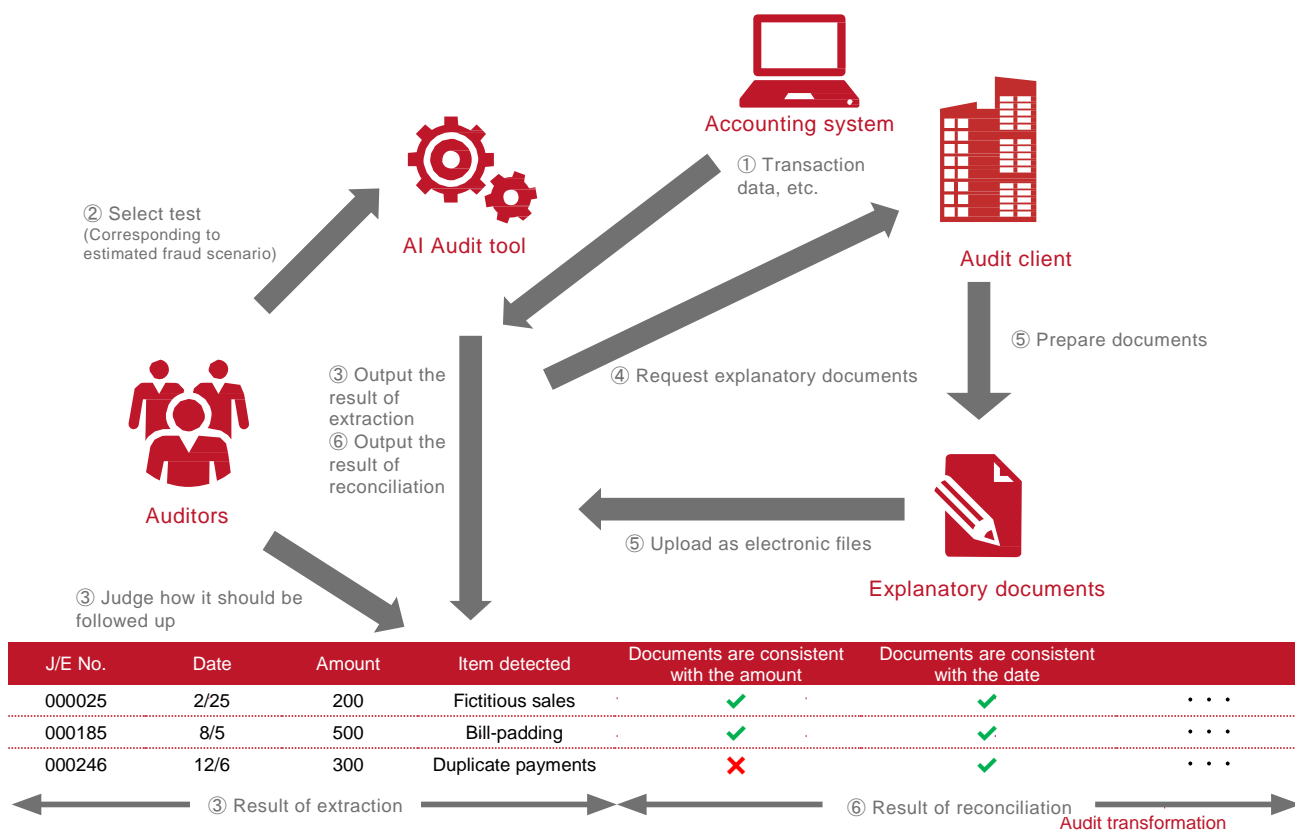
- ④ If the auditor determines it necessary, the AI audit tool raises a request for explanatory documentation.
- ⑤ The client arranges explanatory documentation and uploads the electronic files to the AI audit tool.
- ⑥ The AI audit tool imports explanatory documentation and reconciles them with the test result in ③ and presents the reconciliation result to an auditor.

Just like the inspection of supporting documents, each process and the test results are simplified to show a general approach.

Currently, auditors perform data analysis once or multiple times in a year. Due to an enormous amount of journal entry data, auditors spend a significant amount of time preparing data (Process ①) and conducting manual analyses (Process ③). The AI will semi-automate these works.

The AI will learn it based on exception data and will identify patterns using machine learning, which will enhance future tests. In such case, auditors do not have to set criteria, and AI would detect frauds that auditors had not expected before.

**Figure 4: Flow of journal entry testing using AI audit tool**



## Expected timeline of emerging technology application to audit

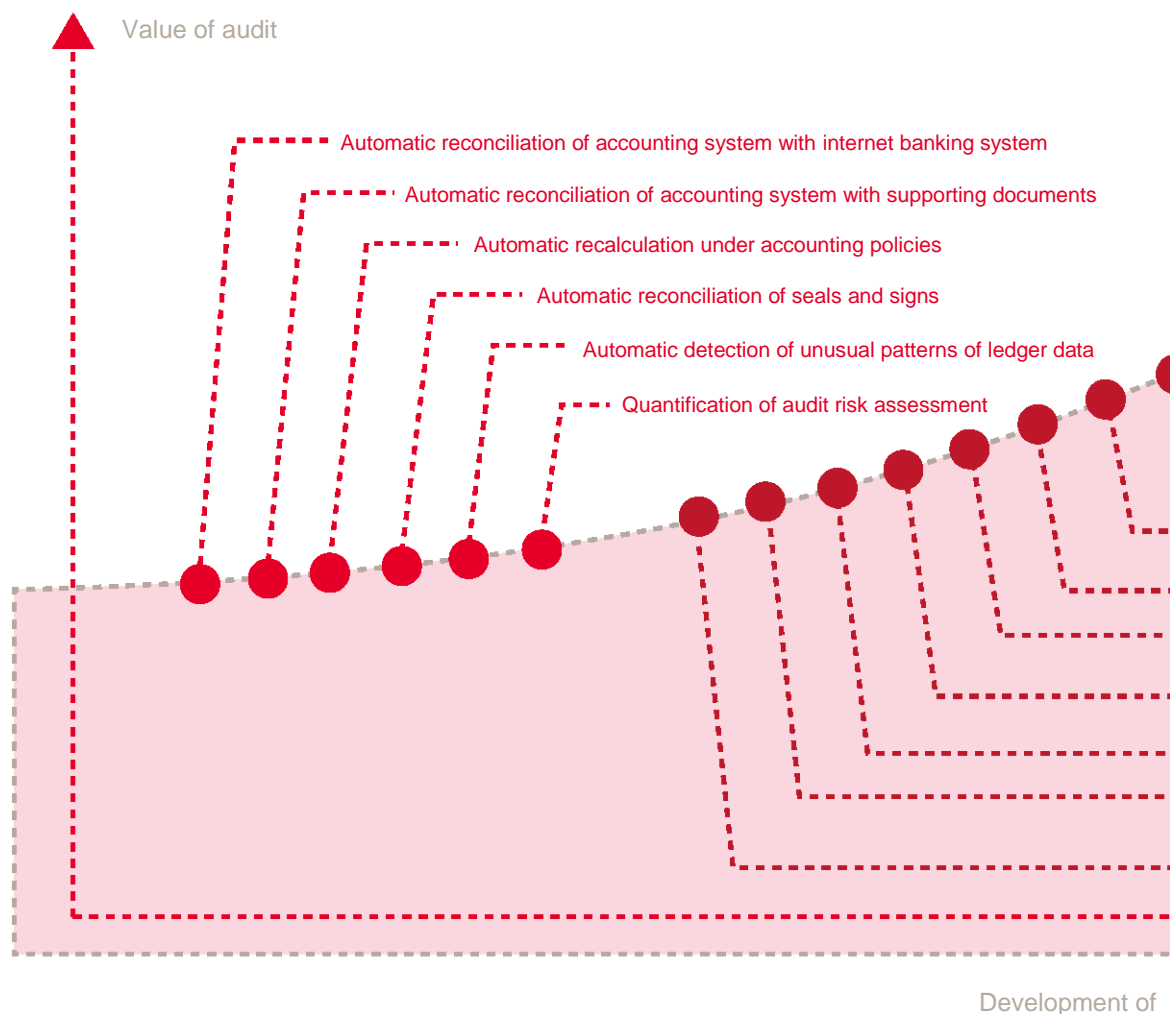
Some AI technologies have currently matured and some are undeveloped from the perspectives of the application to audit procedures. The figure below shows the timeline for how technologies are expected to be applied to audit procedures as they develop (Figure 5).

In the first phase, as an alternative to manual work, RPA is applied to automate reconciliation and calculation among data and systems. The current technology is developed enough to be applied to these works and early introduction is expected.

In the next phase, as deep learning<sup>5</sup> develops, AI will replace some parts of human judgment. Specifically, AI will review details of contracts and verify the quantity of inventories. The current technologies can be applied to some of these areas, but certain areas remain difficult to be applied due to various conditions. Thus, further development of technologies is anticipated.

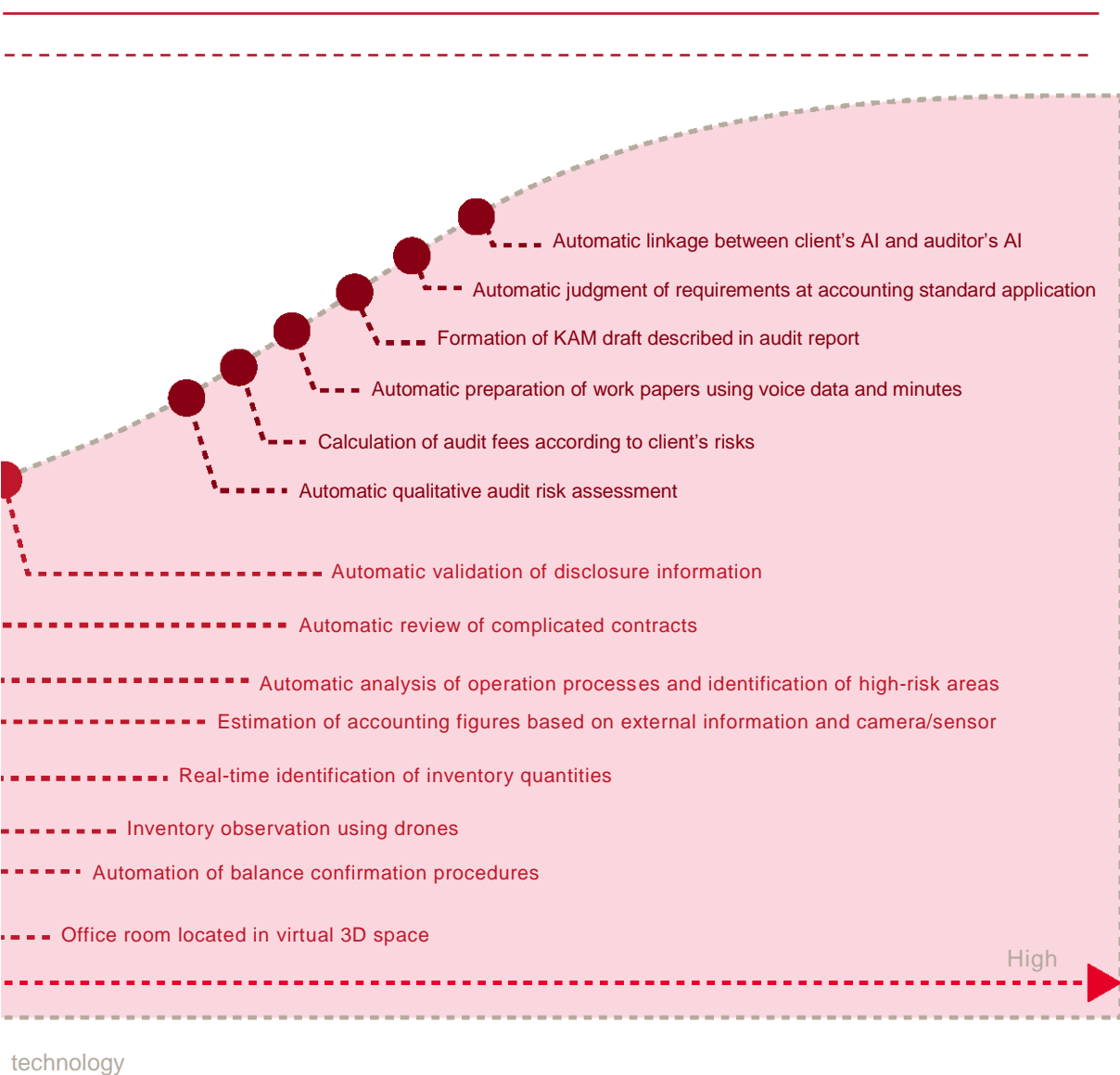
<sup>5</sup> Deep Learning is a type of machine learning that uses many layers of mathematical modeling resembling a cranial nerve circuit (neural network). Generally, a computer, under deep learning, learns patterns from a large volume of data by a complicated method and it needs large-scale calculation compared with other machine learning techniques. Deep learning marks high recognition accuracy in voice, image and natural language and it is applied to various fields, including self-driving system.

Figure 5: Expected timeline of emerging technology application to audit





Eventually in the final phase, development of AI will replace advanced human judgment with algorithms, which may allow AI to provide real-time audits and evaluate risks from a new viewpoint. An auditor will use information that is processed and judged by AI to make his/her decision and immediately resolve problems of the client to enhance the value of an audit.

Wider use of AI in audit procedures will not be in the distant future, but the audit industry will face a transformation of operation in the next few years. New audits being developed with technology will provide enhanced value to meet the actual expectations of stakeholders, and the role of auditors will also become more important for society.



## (Reference) Development of technologies constituting AI and its potential impact on audit clients and auditors

	Current technology	Future trend
 <p><b>Machine learning</b></p> <p>Machine learning is to let a computer classify and estimate data automatically by building algorithms and importing learning data. Using machine learning, we can classify and predict complicated data beyond human information-processing capability.</p>	<p>Supervised learning algorithms have been used in the accounting and auditing industry to optimize predictive models from existing data sources in order to learn patterns and analyze behaviors. Innovative companies are applying to decision-making models the famous clustering/classification algorithms that have been widely studied, including K-means, BIRCH, random forest and SVC.</p>	<p>Corporations will consider applying deep learning, which can imitate and learn human intelligence and important decisions, in order to introduce machine learning into a wider scope of operations. Corporate resources will be heavily invested in research and experiments on the development of a deep neural network in the future.</p> <p>In addition, audit data mining (detection of unusual value and fraud) will become more accurate. By continuously processing hundreds of millions of transactional data, the model will become more precise and effective.</p>
 <p><b>Natural language processing/OCR<sup>6</sup></b></p> <p>Natural language processing is a technology to let computer process natural languages that people usually use. Natural language processing has been used already in a wide variety of fields, including translation, search engines, voice recognition and OCR (optical character recognition).</p>	<p>Natural language processing is used in the accounting and auditing industry to analyze the structure and meaning of sentences. Important technologies have been already widely spread such as syntax analysis, word extraction and OCR. OCR engines enable invoices, purchase orders and receipts and other paper-based documents to be read with a high degree of precision, but the interpretation of a range of expressions can be improved. For example, the current technology cannot accurately read out various, multiple terms from sales agreements and automatically reflect them to accounting systems.</p>	<p>Development of natural language processing in the context of process automation will be prioritized especially in complicated cases, including review of M&amp;A contracts and other atypical contracts. AI platform will integrate and refer various datasets to learn new scenarios.</p>
 <p><b>Audit process automation</b></p> <p>This is an approach to use existing software to automate manual audit works by application software, which aims for reducing costs and increasing service quality and service level. The advancement of AI has widened the scope of automation from simple works, including data input and processing of extracted data, to complicated judgment that has depended on the skill of a person.</p>	<p>RPA technology is maturing. Data collection, rule-based business process management, and automation tools have effectively improved the performance of repetitive tasks. Auditors and accounting departments have reduced staffs who perform time-consuming and labor-intensive works and shift them to high-value and productive works.</p>	<p>After the introduction of RPA, corporations will invest in the automation of judgment based on deep learning technologies. By doing so, corporations can rely on software to recognize patterns from dormant data in business software and make basic decisions and judgments. Ultimately, software will automatically learn and analyze big unstructured data and make accurate predictions directly linked to profitability.</p>



Impact on audit client companies	Impact on auditors
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Deep learning will significantly contribute to number estimation. In particular, corporate estimation of future sales based on huge data will enable more accurate investment plan and workforce schedule. Machine learning will support managerial judgment through data, which now depends on a seat-of-the-pants process.

A company will derive more practical solutions in production planning and distribution of inventories by using machine learning's future predictions. It will easily calculate volume and timing for each production line and distribution plan that minimizes inventory risk and lead time for each production base.

Also, regarding the impact on accounting departments, dates, accounts, and amounts in journal entry will be automatically input by importing supporting documents to the accounting system. As the system will automatically propose entries to defer and accrue accounts and reverse them by reading external data, accounting staffs will be able to focus on approving and correcting journal entries as well as educating machine learning models, rather than inputting data.

Deep learning has a large potential in complex judgment such as risk assessment. The technology will identify business processes with high fraud risks and accounting areas where corporate accountants are apt to make mistakes, and present the optimized resource allocation. When auditing accounting estimates, machine learning models will present the confidence levels of the result of accounting estimate by the audit client if an auditor inputs internal and external data of the client.

Natural language processing will automate the contracts review processes that require a lot of time. For example, it will be shortened from a few days to a few minutes to extract unusual provisions from 100 or more page contracts of financial instruments and merchandise trades.

Also, the daunting task of integrating databases of multiple companies into the same standard will become easy in case of a management integration. AI platform will understand meanings and automatically integrate customer masters, vendor masters, accounts receivable/payable, fixed assets and inventories without duplicates and omissions.

In addition, if process mining<sup>7</sup> develops incorporating natural language processing, quantitative and qualitative value chain analysis will become popular. AI will make proposals, such as which part of a business process should be changed resulting in the number of hours to be saved, or how to change a procurement contract to resolve bottlenecks.

Most of the audit procedures that require natural language will get the benefits. All kinds of data handling tasks are expected to become more effective, including collecting and analyzing multiple data, analyzing a huge volume of minutes and contracts, and drawing up work papers.

As AI will substitute most of the clerical works, people will have to do limited works, such as importing scanned data to computers, checking and approving the judgments made by AI, and instructing AI to correct the gaps between the current and ideal processes. If transactional data between companies are all digitalized, it will be unnecessary to scan paper slips.

A logistics cycle is also expected to be automated significantly by using the sensor data from IoT devices. Incoming and outgoing inventory checks at a warehouse will be automated by RFID<sup>8</sup>, and some industries may count the inventories in a warehouse on a real-time basis. Operations within a warehouse may be covered by AI with the introduction of robots. If self-driving trucks transport goods between warehouses, it will be possible to manage a large-sized warehouse by only a few people.

If AI automates accounting, auditors will audit the client's AI by using the auditor's AI. The traditional audit procedures on a test basis will disappear, and the audit AI will learn all business processes from the client's AI. The audit AI will reconcile and verify all transactions with supporting data with reference to the latest accounting standards. The audit AI will provide additional investigation of any errors detected. Auditors will review the entire procedure performed by AI and judge that reasonable assurance is obtained based on the results.

<sup>6</sup> OCR (Optical Character Recognition) is a technology to read handwriting and printed characters as graphical data and recognize and convert characters into text data. Converting characters into text data enables a computer to treat character information.

<sup>7</sup> Process mining is a technology to analyze a business process based on execution log data in the system. Process mining can find problems in a business process, investigate the cause and improve such business process by recognizing the trends and patterns of data.

<sup>8</sup> RFID (Radio Frequency Identification) is a technology to read and write the data of memory-embedding ID information (RF tag) by using short-range radio communication. It is used in the forms of fare payment systems, employee ID cards and logistics tags for the purpose of streamlining transportation/logistics operations and security measures.

# *Outline of PricewaterhouseCoopers Aarata LLC and Genial Technology, Inc.*

By deepening its IT utilization and collaborating with PwC global network across 158 countries in 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 next-gen audit services.

Genial Technology is a company with the aim to offer software that automates audit procedures, including accounting data cleansing and exchange of audit documents between an auditor and its audit client company, by utilizing cloud computing and artificial intelligence technologies.

The missions of PwC Aarata and Genial Technology are complementary, providing an excellent mix of expertise and interests for collaboration in this type of activity. For example, PwC Aarata brings a broad range of expertise in audit practice, Genial Technology provides expertise in data cleansing, analysis and AI model development.

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