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2021 International Conference on Computer Auditing in Tokyo
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INTERNATIONAL JOURNAL OF COMPUTER AUDITING
Editorial

Virtual Exchange (VE): A New Approach When Teaching Audit Data Analytics

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Virtual exchange (VE) is defined as "technology-enabled learning experiences with clear learning outcomes and deliverables, in which sustained communication and interaction takes place between students (individuals or groups) who are geographically separated, with the support of educators" (DePaul University, 2020). Based on this definition, there are several key features in a virtual exchange arrangement (DePaul University, 2020):

- It is technology enabled or facilitated: with the support of information technology (IT), students in different geographic regions can now interact easily.
- It is carefully designed by two or more professors with clearly defined learning outcomes typically through one or more shared assignments or projects.
- It is designed to increase the number of intercultural experiences through interactions and communications between students who are geographically separated.

Virtual exchange has been widely discussed in the past two decades (Zak, 2021). For example, Hauck et al. (2020) discuss pedagogical competence development in teacher education in the virtual exchange context. Lee and Sauro (2021) address and document the language learning processes through virtual exchanges. There are also conferences, such as the International Virtual Exchange Conference [1] and the Biennial Asia-Pacific Virtual Exchange Association (APVEA) Conference [2] , and journals, such as the Journal of Virtual Exchange [3] and Online Learning Journal [4] , discussing virtual exchange related topics. However, the incorporation of virtual exchange in accounting or data analytics is still very limited (e.g., Wang and Warshaw, 2021).

[1] http://iveconference.org/
[2] https://apvea.org/
[3] https://journal.unicollaboration.org/
[4] https://olj.onlinelearningconsortium.org/index.php/olj

The virtual exchange arrangement fits nicely when designing an audit data analytics course because of the followings. First, for audit firms or organizations nowadays, it is not uncommon to have a global arrangement of shared IT services or IT solution teams (Deloitte, 2016; Bachinger, 2021). For instance, KPMG and Protiviti both have software development teams in India (KPMG, 2016; Protiviti, 2021). Discover Financial Services has a data subsidiary in Shanghai focusing on data analysis and modeling (Businesswire India, 2008). With such arrangements, it is crucial for our auditors to be able to work in a global team. In addition, the communication between team members who have very different educational and cultural background requires more practices. Understanding the differences in how people think, express their opinions, and present their ideas can ensure the communication among team members or across global teams to be more effective. Lastly, the interpretations of the findings of audit data analytics and the recommendations rely heavily on the local institutional contexts and the understanding of different business operations and priorities. The intercultural experiences can be a great starting point for auditors to incorporate these additional institutional backgrounds into the decision-making processes.

With all these potential benefits in mind, during the Spring semester (quarter) 2021, DePaul University and National Chung Cheng University in Taiwan arranged a virtual exchange project for their audit data analytics courses. The arrangement lasted for seven weeks for a joint audit data analytics final project. The setting follows the recommended structure for a virtual exchange project: empathy building, virtual exchange activities, and reflection. The first two weeks were the empathy building phase. Students from both universities had an opportunity to read articles about cultural and communication differences between the US and Asian countries. They also had their first virtual meeting to introduce themselves and to start their planning processes. The next four weeks were centered around weekly interactions among student groups for discussion and actual data analysis. Towards the end, students had a chance to reflect what went well and what did not go well. They were also able to discuss or share this experience with their peers and the organizing professors.

A virtual exchange project requires detailed planning and coordination between participating programs. With the efforts, we can bring the intercultural collaboration and communication experiences to audit data analytics courses or other accounting courses. Such experience can help our future auditors be more mindful about the differences between global communities and be successful when working with or leading a global team.

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INTERNATIONAL JOURNAL OF COMPUTER AUDITING
Article

A Smart Audit Teaching Case Using CAATs for Medicare

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Risk is inherent at all levels of hospital management such as determining healthcare service priorities, purchasing new medical equipment, patient safety, clinical governance, etc. The effectiveness of an audit process in reducing risk is a critical success factor in hospital management. Since hospital data is becoming increasingly larger, the data may be too large for auditors to handle. Consequently, they need to learn a new skill and knowledge to face the digital transformation era. The era of intelligent audit technology has arrived. In the future, auditors can use big data analysis and technology to get the assistance of advanced audit analysis tools. This paper introduces a smart audit case using diagnosis-related group (DRG) data. It explains how to use computer-assisted audit techniques (CAATs) to develop the predictions of DRGs as a starting point, triggering students to analyze the editing of DRG codes in depth by using a machine-learning model to pre-audit the accuracy of inpatient DRGs' drop point in Health Insurance Declaration forms.

KEYWORDS
hospital management, diagnosis-related groups (DGRS), smart audit, (computer-assisted audit techniques (CAATS), machine learning

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1 | TEACHING CASE MOTIVATION

Improper Medicare payments and Medicare fraud are important management issues in the modern healthcare ecosystem in Australia. Improper Medicare payments refer to payments that do not meet statutory, regulatory, administrative, or other legally applicable requirements and may be overpayment or underpayment. Additionally, improper payments do not necessarily represent expenses that should not have occurred. For example, current OMB guidance states that when an agency's review is unable to discern whether a payment was proper because of insufficient or missing documentation, this payment should be considered an improper payment. U.S. Government Accountability Office (GAO) estimated to be about $52 billion improper payments for Medicare in fiscal year 2017.

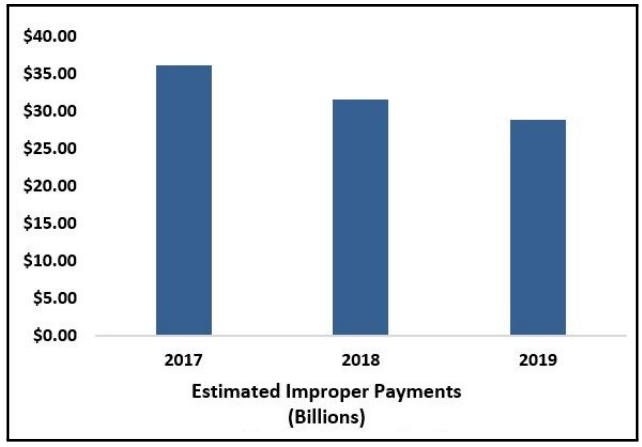


FIGURE 1 Medicare Fee-for-Service Estimated Improper Payments (in Billions) 2017-2019 USA. (S. J. Bagdoyan, 2017)

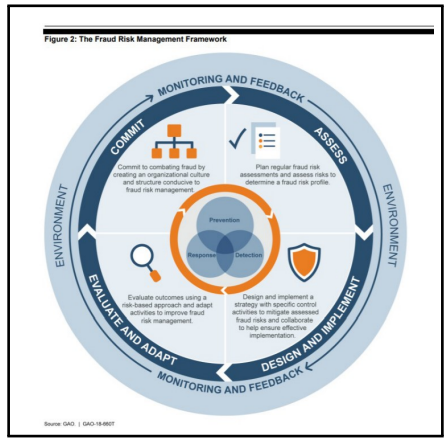


FIGURE 2 The Fraud Risk Framework describes leading practices in four components: commit, assess, design and implement, and evaluate and adapt. (S. Bagdoyan, 2018)

Medicare fraud is the claiming of Medicare health care reimbursement to which the claimant is not entitled. There are many different types of Medicare fraud, all of which have the same goal: to collect money from the Medicare program illegitimately (Medicare Fraud and Fraud in Other Government Healthcare Programs, 2017). The Columbia/HCA fraud case is one of the largest examples of Medicare fraud in U.S. history. Among the crimes uncovered were doctors being offered financial incentives to bring in patients, falsifying diagnostic codes to increase reimbursements from Medicare and other government programs, and billing the government for unnecessary lab tests. (Moewe 2006)

The GAO made three recommendations, namely that CMS (1) require and provide fraud-awareness training to its employees; (2) conduct fraud risk assessments; and (3) create an antifraud strategy for Medicare, including an approach for evaluation. Accordingly, the recommendations, it is important to have a smart audit teaching case for auditor or administrator of the hospital. (https://www.cms.gov/newsroom/fact-sheets/2019-estimated-improper-payment-rates-centers-medicare-medicaid-services-cms-programs)

2 | BASIC MEDICARE KNOWLEDGE

The performance assessment of medical services offers a basis for rational decision-making and service improvement, making these an important part of medical services research (France, 2003; Fung, Lim, Mattke, Damberg, & Shekelle, 2008; Pinnarelli et al., 2012). When assessing the service performance of different healthcare providers from different hospitals, the conventional method relies on measuring the number of discharged cases and operations, average length of stay, bed rotation rate, and so on. However, this method does not consider the effects of the disease or disease difficulty; thus, it cannot provide an objective assessment result. To assess the service capacity of different medical service providers, "case-mixing" is used to classify cases with similar clinical processes or resource consumption, allowing cases in the same group to be directly compared (Iezzoni, 1997).

A diagnosis-related group (DRG) is a type of case-mix system that classifies hospital discharge cases according to clinical process consistency and homogeneous resource consumption. This system is a popular health service management tool (France, 2003; Jian, Mu, & Zhang, 2013; PL, 1983). It was first developed by Fetter et al. (1980) at Yale University in 1967 and has been used in the U.S. since 1982 and implemented in Europe and fast-developing countries in Asia and Sub Saharan Africa (France, 2003). Thus, the DRG system has become widely used in multiple areas, including healthcare reimbursement, health expenses budgeting, cost control, health service performance assessment, quality assurance, and planning (Accardo, Damiani, Damiani, Geraci, & Tomasello, 2011; Barker, Brand, Evans, Cameron, & Jolley, 2011; France, 2003; Mihrshahi et al., 2010; Mistichelli, 1984) (See Figures 3-4).

Computer-assisted coding (CAC) is defined as "the use of computer software that automatically generates a set of medical codes for review, validation, and use based upon clinical documentation of the healthcare practitioner." Currently, there are two key financial issues driving CAC adoption: healthcare reimbursement and compliance with anti–fraud and abuse regulations. CAC provides healthcare organizations and providers with a mechanism to reduce potential issues of fraud and abuse in medical coding. Building upon health information technology platforms, certified CAC software provide coding based upon standard coding principles and guidelines.(Group, 2004) They provide prompts and decision-support tools that assist healthcare entities and providers in preparing the supportive documentation required for specified levels of care in a timely and accurate manner. The implementation of CAC in the healthcare environment fosters system integrity through increased compliance with identified standards and protocols, thereby



FIGURE 3 DRG analysis and strategic healthcare budgeting. Source: (Accardo et al., 2011)

FIGURE 4 Timeline shows the evolution of federally funded health care programs.Source: (Averill, 1989)

further reducing miscoded claim submissions (Garvin, Watzlaf, & Moeini, 2006).

To cooperate with national policies, the budgeting method of regional hospitals can be used to realize the principle of fairness and justice. Computer assisted audit techniques for predicting the drop of DRG can help medical management and accounting personnel achieve a win-win situation for hospital revenue and the improvement of national health. In addition, it can prevent medical institutions from cheating on health insurance income.

3 | TEACHING CASE OBJECTIVES

Judging from the continuous occurrence of major financial fraud incidents in the world, we can see the long-term deviation of risk awareness, and how to effectively implement internal control and improve the concept of audit system whether it is corporate departments, government departments or NGO groups. In addition to the international requirements for compliance with regulations, effective risk management operations focus on the intervention of the three lines of defense of internal control.

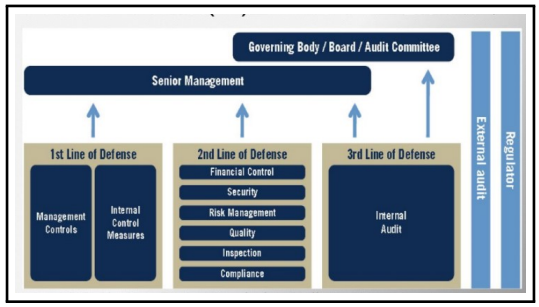


FIGURE 5 Three lines of defense in internal control. Source: (Anderson & Eubanks, 2015).

The U.S. Committee of Sponsoring Organizations of the Treadway Commission (COSO) and the International Institute of Internal Auditing (IIA), in an IIA position paper, stated that there are three lines of defense in internal control as follows:

1. The first line of defense comprises the functions that own and manage risk.
2. The second line of defense comprises the functions that oversee risk.
3. The third line of defense includes functions that provide independent assurance.

The first line of defense is responsible for and continuously manages the risks that arise from operational activities. The function of the second line of defense is to formulate overall policies and establish a management system to assist and supervise the first line of defense in risk management and self-assessment implementation. The third line of defense is the internal audit unit, responsible for checking and evaluating the effectiveness of internal control and risk management systems, which are designed and implemented by the first and second lines of defense and providing suggestions for improvement in a timely manner. (Anderson & Eubanks, 2015)

The accounting audit system is the third line of defense. The audit unit and accountants should improve upon the items listed in the inspection opinions and address missing items listed in the review and internal control system statement. Such issues should be reported to the supervisors or audit committees for review as an important item for rewards, punishments, and the performance appraisal of each unit. Thus, the lack of internal control can be addressed. With the introduction of CAC and accounting audit systems, the effectiveness of the internal control and risk management systems will be implemented by the third line of defense. It also provides healthcare organizations and providers with a mechanism to reduce potential issues of fraud and abuse in medical coding (Cangemi, 2013).

DRGs aim to classify patients into several categories based on similar clinical conditions and the level of hospital resources required for similar treatments. These categories are identified using DRG codes, each of which is assigned a relative weight according to the relative amount of hospital resources used to treat patients. These relative weights are used to calculate the reimbursement for paying more when a patient's care requires more resources and reducing the payment when a patient's care requires fewer resources. Therefore, the best DRG manager for a specific healthcare payer is the organizer who can most accurately predict the relative hospital resource usage of all services reimbursed by the payer from the perspective of hospital reimbursement. Considering the importance of providing reasonable service payments, DRG managers should classify the length of hospital stay to most accurately predict the relative

hospital resource usage of the care provided to each patient. In addition, DRG grouping has other benefits, such as helping measure the quality of hospitals and classifying the types of care reimbursed by payers. Likewise, as with any tool, DRG groupers need to be assessed for long-term viability and reliability. In summary, the criteria recommended for evaluation of different DRGs are as follows:

- Accuracy in categorizing the relative cost of care for the full range of services reimbursed by the Medicaid agency.
- Long-term viability in the ever-evolving healthcare industry
- Ability to contribute to the measurement of hospital quality.
- Familiarity and experience being used in the industry.

Medical Managers' Need for Accurate Prediction of DRG Drop Point

The selection of a DRG Grouper for a Medicaid population is an important job. DRG service performance indicators are calculated using DRGs based on large sample data, thereby producing highly objective results. Thus, when evaluating the clinical specialty of a hospital's medical services, DRG technology provides a useful clinical specialty classification tool for hospital managers. It also provides a basis for comparing the performance indicators of different service providers in the same specialty using objective data. Therefore, these DRG-based assessments of specialty medical service performance allow hospital managers to objectively understand their specialty's service performance, including their strengths and weaknesses, providing scientific and objective assistance and guidance for improving the service quality (Barros, 2003; Fung et al., 2008; McKay & Deily, 2005; Pirson et al., 2013). Notably, complicated case-mix systems such as DRGs are based on good medical information systems and valid data (Averill, 1989; Geissler, Quentin, & Busse, 2015; Simoes, Freund, Grzeschiuchna, Schwoerer, & Schmahl, 2002). In other words, the validity of applying DRGs as a tool for risk-adjustment and healthcare management is seriously dependent on the coding quality of the discharge data. Therefore, all countries must consider the importance of implementing DRG systems, to establish and maintain accurate and effective medical information systems (Martins & Travassos, 1998; Tzavaras, Spyropoulos, & Gruen, 2006).

4 | BACKGROUND OF THE TEACHING CASE

4.1 | Industry Outlook

The DRG payment system was developed in the 1960s at Yale University in the US due to concerns about high costs and the search for alternative methods of payment. The DRG system was officially adopted in 1983 by the US Health Care Financing Administration (HCFA) as the basis for payment for hospitalization of Medicare patients. The DRG system has been the basis for paying for hospital care in the US since 1999 by most health insurers and has been adopted by other industrialized countries. In the DRG system, hospitals are funded based on a predefined payment rate for diagnoses or procedures in 495 classifications. This incentivizes the appropriate use of services with a reduction in length-of-stay, efficient use of diagnostic and treatment procedures, and reduces overall bed capacity. The DRG system, however, encouraged the falsification of diagnoses or reported severity of case definitions

to increase revenues, which became known as "DRG creep." Prospective payment systems, such as DRGs, support rational use of hospital care as an effective way to achieve a balanced health service system and must be associated with quality assurance mechanisms. A regional approach for hospital budgeting as part of a comprehensive network helps to achieve equity and provides incentives for increasing health in the population.

DRGs are a type of hospitalization payment system that divides the doctors who diagnosed patients with the same type of disease and conducting similar treatment into the same group. Then, the patients are divided according to patient's age, gender, presence or absence of complications, and discharge. The conditions are subdivided into groups, and the group of diseases in the same group is calculated based on the data of the services provided by the medical community in the past. This system is implemented to calculate future hospitalization expenses that the insurer should pay to the hospital. The payment method is called "package payment."

4.2 | Teaching Objectives and Activities

The main goals of DRG policies are as follows:

- To improve the efficiency of medical services (reduce waste)
- To improve patient care quality and efficacy via the clinical path.

Meanwhile, the design principles of DRGs are as follows:

1. To maintain the overall point value of hospital's stability.
2. To keep the principle of flat for total points before and after the implementation.
3. To protect critical patients and reduce hospital financial impact.

The proposed teaching case can train students to answer the following key questions:

1. How can the drop point of the DRGs be predicted?
2. What analytic parameters can be used to analyze the DRGs?
3. Can a machine-learning project be created to learn from the case and predict the drop point of the DRGs?
4. What good learning parameters can be used for the DRGs machine-learning model?
5. How can the machine-learning result model be evaluated as a good knowledge model?
6. How can students extend their new knowledge from the self-directed project to predict bankruptcy for other hospitals?

4.3 | Prediction Analytics for DRGs

The results vary depending on the cost of taking care of patients in the hospital for each disease. Practically speaking, the drop point of the classification report is divided into four major areas:

1. Area A. This drop point is below the threshold of the lower cost limit, which is used to verify the declaration. In other words, the amounts of patient costs and health insurance payments are determined.
2. Area B1. This drop point is between the threshold of the lower limit of the cost and the fixed payment point, which is the hospital's money-making area. Thus, the cost of treating patients is low, but the health insurance still pays the amount.
3. Area B2. This drop point is between the fixed payment point and the tipping point of the upper limit of the cost, in which the hospital district loses money.
4. Area C. This drop point above the threshold of the upper limit of the cost, which is the hospital's money loss area. The cost of exceeding the upper limit threshold will be paid 20% off.

The hospital expenses of DRG payment are calculated as follows.

For example, DRG will have a fixed payment amount X, also called fixed payment, a lower cost threshold, and the tipping point. The results vary depending on the cost of taking care of patients in the hospital for each disease. Practically speaking, the drop point of the classification report is divided into four major areas:

1. *Area A.* This drop point is below the threshold of the lower cost limit, which is used to verify the declaration. In other words, the amounts of patient costs and health insurance payments are determined.
2. *Area B1.* This drop point is between the threshold of the lower limit of the cost and the fixed payment point, which is the hospital's money-making area. Thus, the cost of treating patients is low, but the health insurance still pays the X amount.
3. *Area B2.* This drop point is between the fixed payment point and the tipping point of the upper limit of the cost, in which the hospital district loses money. Therefore, the cost of treating patients is higher than X, but health insurance will only pay the X amount.
4. *Area C.* This drop point above the threshold of the upper limit of the cost, which is the hospital's money loss area. Thus, the cost of treating patients is higher than X, but the health insurance will only pay X amount, and the cost of exceeding the upper limit threshold will be paid 20% off.

For example, the fees in the examples are hypothetical, and the actual payment is based on practice. Today, a patient with appendicitis is arranged for admission to the hospital. The fixed payment point for appendicitis is 10,000 points. The lower and upper limits of the cost are 5,000 and 15,000 points, respectively. The hospital may face the following three conditions for DRG payment.

1. If the patient is cured, the area of payment point is A with 3,000 incurred cost. The hospital can then apply for a 3,000-health insurance payment. In other words, the hospital did not make any profit.

2. If the patient is cured, the area of payment point is B1 with 7,000 incurred cost. The hospital can then apply for a 10,000health insurance payment. In other words, the hospital earns 3,000 points.
3. If the patient is cured, the area of payment point is B2 with 18,000 incurred cost. The hospital can then apply for a 2,400health insurance payment. In other words, the hospital loses 5,600 points [10,000 + [(18,000 15,000) × 0.8 = 2,400].

To properly use health insurance resources and take care of all people with medical needs, the selection of a DRG grouper for a medical population is critical. We hoped to establish this teaching case to help DRG grouper in predicting DRGs as a starting point, thereby triggering students to analyze the editing of DRG codes in depth through the machine-learning model using computer-assisted audit techniques (CAATs). This, in turn, will allow for the accurate prediction of the drop point of The National Health Insurance Inpatient DRGs.

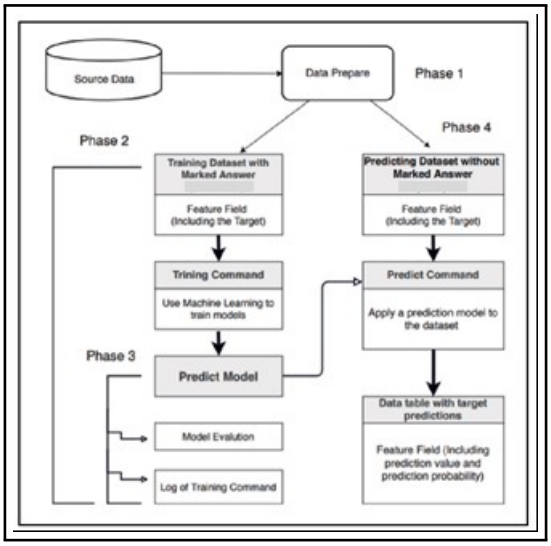


FIGURE 6 Structure diagrams of the machine-learning process. Source: (Huang & Wang, 2020)

4.4 | Machine-Learning Method

Figure 6 illustrates the four main phases in the supervised learning process. Supervised learning, also known as supervised machine learning, is a subcategory of machine learning and artificial intelligence. It is defined using labeled datasets to train algorithms to classify data or predict outcomes accurately. As input data is fed into the model, it adjusts its weights using a reinforcement learning process, which ensures that the model has been fitted appropriately. Supervised learning helps organizations solve for a variety of real-world problems at scale. Supervised learning uses a training set to teach models to yield the desired output. This training dataset includes inputs and correct outputs, which allow the model to learn over time. The algorithm measures its accuracy through the loss function, adjusting until the error has been sufficiently minimized. (Rouse, 2020)

Phase 1: Data Preparation

The machine determines the laws from the massive amounts of data; hence, it must deal with inconsistent data formats, missing or invalid values, and so on to keep the data clean. The other process in this phase is called feature extraction, which extracts useful features from the data, such as consumption amount.

Phase 2: Training

Data scientists choose machine-learning models with appropriate performance. Many machine-learning algorithms exist, such as neural networks, random forests, support vector machines, and decision trees. These algorithms are difficult to learn for most business school students, especially accounting students. To avoid this difficulty, CAAT tools, such as ACL, integrate the above artificial intelligence (AI) algorithms as a backhand learning model. Students can simply use the frontend TRAIN command interface to submit the training data with several parameters into the backend AI algorithms to implement the machine-learning process, which runs suitable AI algorithms. The system then generates a prediction model.

Phase 3: Model Evaluation

Students must evaluate the prediction model. Several methods exist to evaluate the performance of the prediction model. Students should learn these methods and make a professional judgment in selecting a good prediction model.

Phase 4: Prediction

If students accept the prediction model, they can put the model into the prediction dataset using the PREDICT command. The result of the dataset includes two new fields: the prediction value and prediction probability.

Phase 1: Data Preparation

The collated data used in this teaching case were recorded in an Excel file (DRG_data_predicted.xlsx). The training data with the sheet name "train" covered the 2019.1–2019.12 period for this case. Meanwhile, the prediction data with sheet name "predict" cover the 2020.1–2019.9 period for this case. Table 1 presents the data structure of the teaching case. Students must import the "DRG_data_predicted.xlsx" with sheet name "train" as training data into ACL/ for further machine-learning processing using the command "Import" on the ACL software menu. Students can select the import command by following the Wizard to import the data. Figure 7 depicts the Import process flow.

Table 1: The major data structures of the teaching case

Source: https://www.nhi.gov.tw/Content_List.aspx?n=DCCBE9C48349FFF0&topn=5FE8C9FEAE863B46

Field Name	Data Type	Description
Geometric mean hospital stays	Numeric	Calculate the geometric mean hospitalization days of each DRG based on the data in the relative weight calculation range. The number of hospitalization days required by the patient should be determined by the professional judgment of the clinician.
Major Diagnostic Category	Category	The main disease categories of Tw-DRGs are PRE MDC, MDC1 to MDC24
Medical fees	Numeric	The medical fees include diagnosis, ward, tube feeding, examination, radiologic, therapeutic, surgical, rehabilitation, hemodialysis, anesthesia, specific devices, medicine, medicine expenses, psychotic therapy, injection service, baby care, part of the burden, difference costs,
TWDRG code	Category	Consider the DRG classification based on the complete hospitalization data of the case
Relative weight (RW)	Numeric	The average number of points per person for a DRG/the average number of points per person for a certain DRG. The higher the value, the higher the resource consumption of the case combination.
Standardized Payment Rate (SPR)	Numeric	"National Total Points/National Total Weight" and adjusted benefit value.
Case mix index (CMI)	Numeric	(Number of cases in each DRG * Relative weight of each DRG) Total / Total number of DRG cases. The higher the value, the higher the complexity of the case and the more medical resources required
Lower critical point	Numeric	It is determined based on the 2.5 percentile value of the DRG medical service points.
Upper critical point	Numeric	The same percentile value of each DRG is calculated based on the principle that the total number of points before and after the implementation is flat and the total payment points of the part above the upper limit of the threshold are 5.1%.
Marginal Cost	Numeric	Each unit of newly produced product (or purchased product) brings an increase in total cost
TWDRG payment points	Numeric	RW × SPR × (1+Basic diagnosis and treatment bonus rate + children bonus rate + mountain outlying island area hospital bonus rate)
The drop point	Category	Dependent variable.

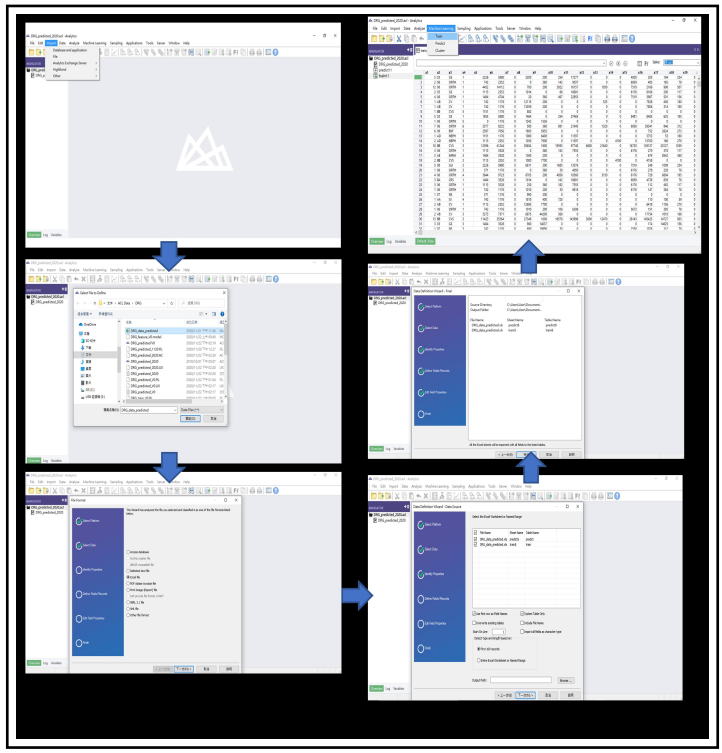


FIGURE 7 Import process flow.

Phase 2: Training

The ACL software has added the "Machine Learning" command that is divided into datasets using tagging classification features: the "Training" machine recognition rules and "prediction." The two parts of the results of the new dataset and the detailed operation process are as follows:

Machine-learning time

The function provides users with the time to set the machine-learning analysis data to determine the best model. Moreover, it provides the maximum analysis time for each data point to determine the analysis measurement mode, marker classification features, and training factors.

Select prediction variables.

The following are the Tw-DRG review key points: the necessity of admission or main surgery (treatment), the appropriateness of diagnosis and treatment, the correctness of diagnosis and treatment codes, the transfer of expenses related to the scope of hospitalization, the appropriateness of medical expenses for cases exceeding the upper limit threshold (Outlier), and whether the discharge status is stable. Thus, we consider and try importing several quantified amounts as variables.

Training model selection

The training model is divided into two categories: classification and regression. The result of the prediction required in this teaching case is "Benefits area of DRGs," which is divided into two types of results. The first type is "Target," which indicates a high probability of hospital making-money, and the second type is "Non-target," which indicates a hospital balanced or loss of health insurance payment. In this teaching case, the prediction model formed by machine learning training is named the "DRG_Model," and the result of the model evaluation data is stored as "DRG_Evaluation." The ACL forms the prediction models and model evaluation results (Figure 8).

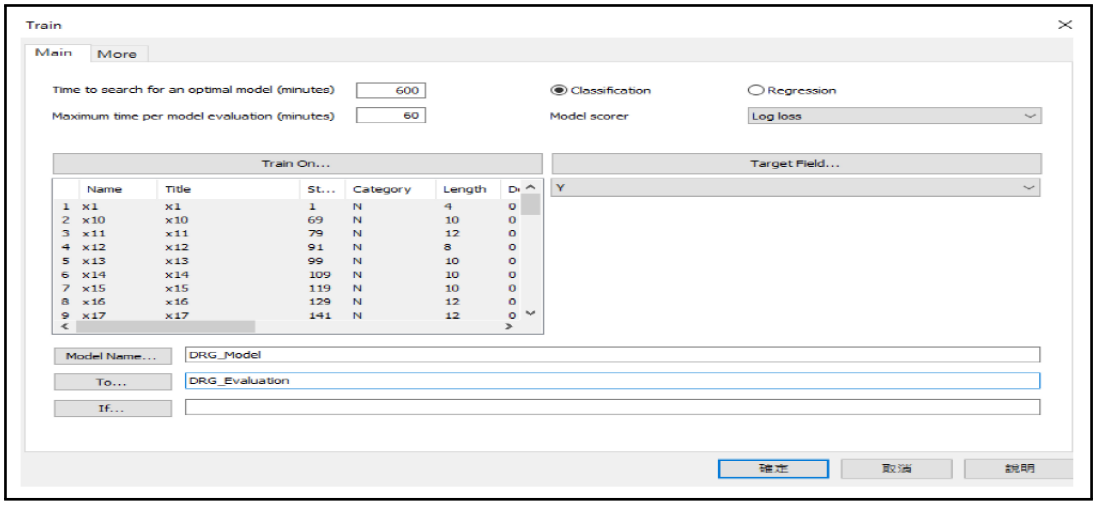


FIGURE 8 Set the machine-learning training method and time.

After the training, ACL selects the best machine-learning algorithm from the selected scorer to build the prediction model. Here, ACL selects "Gradient Boosting Classifier" as the machine-learning algorithm (Figure 9). For the details of the algorithm, students can read relative machine-learning textbooks (Geurts, Ernst, & Wehenkel, 2006). For data analytics, evaluating the model is more important than going into detail regarding the algorithm.

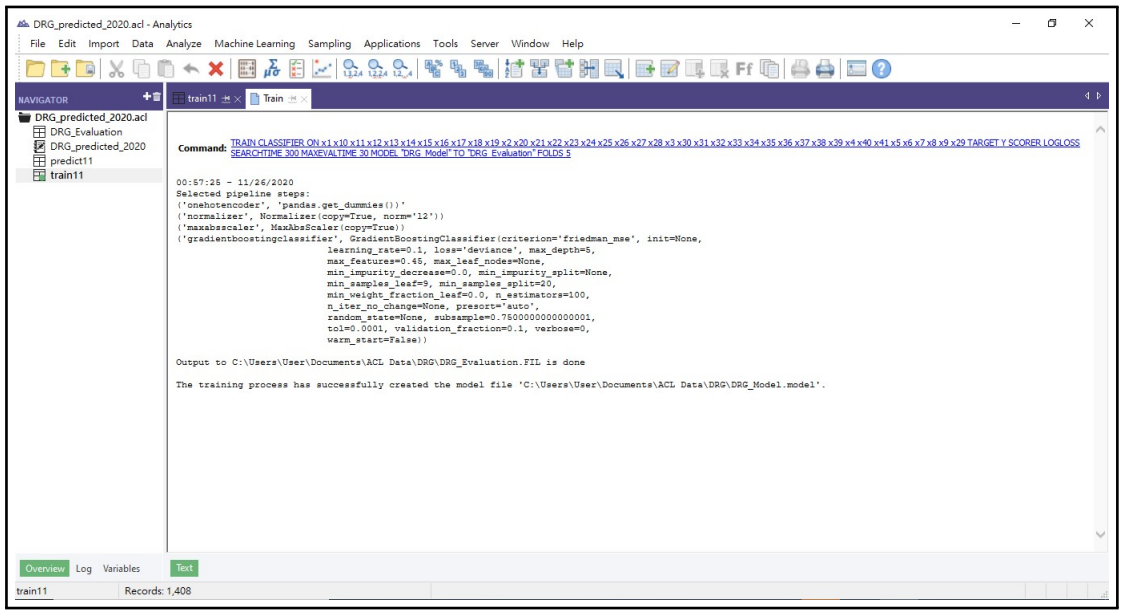


FIGURE 9 Machine-learning training result

Phase 3: Model Evaluation

To learn how to evaluate the classification models, students should learn about the confusion matrix (Figure 10). The true positive (TP), true negative (TN), false positive (FP), and false negative (FN) are extracted from the confusion matrix after the classification operation (Narkhede, 2019). When the "training" machine-learning analysis data rules are completed, ACL provides the model correlation coefficients found in the learning process and the weight standard of the relevant indicators. Then, ACL evaluates the reliability of the model formed after machine learning. Figure 11 presents the machine-learning training prediction model evaluation results and the metrics. To determine the detection efficiency of the proposed algorithms, metrics, such as accuracy, precision, recall, and F1, can be used. The definitions of these metrics are presented in Figure 11.

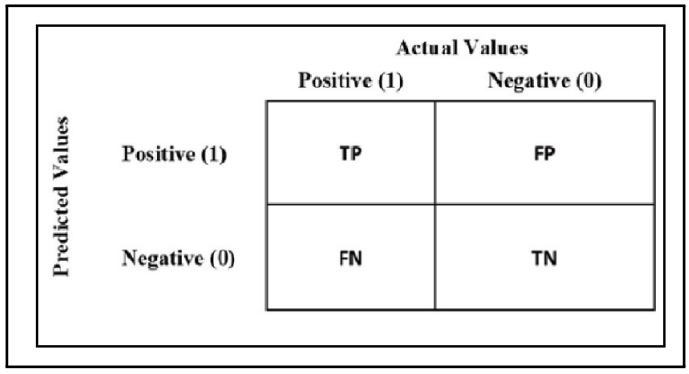


FIGURE 10 Confusion Matrix. Sources: (Narkhede, 2019)

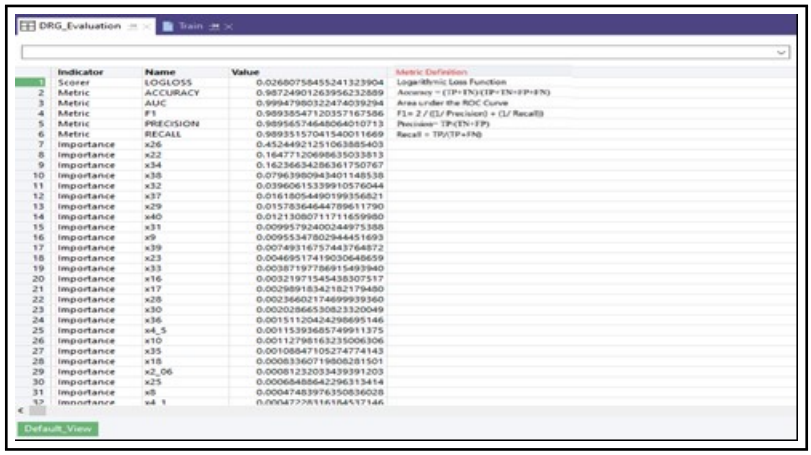


FIGURE 11 Evaluation results.

Phase 4: Prediction

When the training model has been established, the teacher can perform a "prediction" function on the new dataset (no classification features) according to the learning process model to determine whether the judgment results of the new data are accurate. First, the prediction data (DRG_data_predicted.xlsx) are imported. Then, students will click the machine learning in the function menu and the Predict command. Figure 12 illustrates the Predict command interface. Students input the model's name "DRG_Model.model," which is learned in the training process phase. After the prediction instruction is executed, the system automatically saves the prediction results to the "DRG_predicted_2020" table (Figure 13). A predicted "target" is generated, which indicates a high probability of hospital profit. Thus, the machine-learning case successfully predicts the accurate drop point of DRGs.

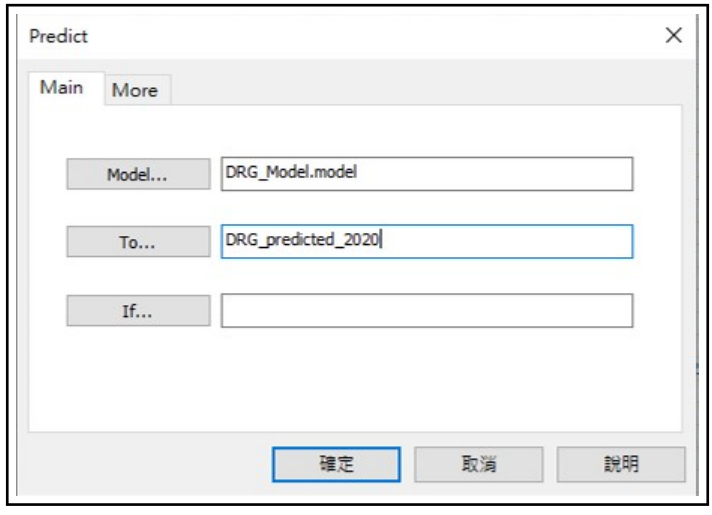
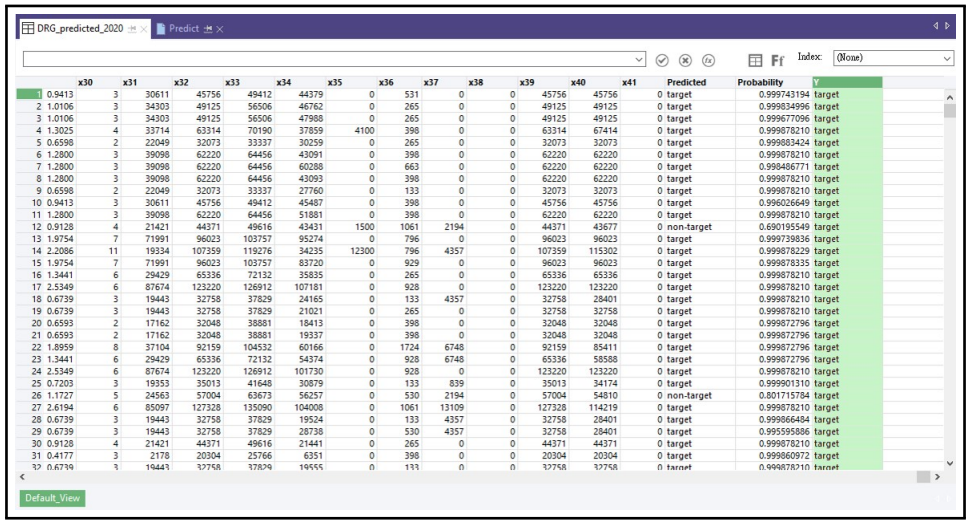


FIGURE 12 Predict command interface



	x30	x31	x32	x33	x34	x35	x36	x37	x38	x39	x40	x41	Predicted	Probability	Y
1	0.9413	3	30611	45756	49412	44379	0	531	0	0	45756	45756	0	target	0.999743194	target
2	1.0106	3	34303	49125	56506	46762	0	265	0	0	49125	49125	0	target	0.999834996	target
3	1.0106	3	34303	49125	56506	47988	0	265	0	0	49125	49125	0	target	0.999677096	target
4	1.3025	4	33714	63314	70190	37859	4100	398	0	0	63314	67414	0	target	0.999878210	target
5	0.6598	2	22049	32073	33337	30259	0	265	0	0	32073	32073	0	target	0.999883424	target
6	1.2800	3	39098	62220	64456	43091	0	398	0	0	62220	62220	0	target	0.999878210	target
7	1.2800	3	39098	62220	64456	60288	0	663	0	0	62220	62220	0	target	0.998486771	target
8	1.2800	3	39098	62220	64456	43093	0	398	0	0	62220	62220	0	target	0.999878210	target
9	0.6598	2	22049	32073	33337	27760	0	133	0	0	32073	32073	0	target	0.999878210	target
10	0.9413	3	30611	45756	49412	45487	0	398	0	0	45756	45756	0	target	0.996026649	target
11	1.2800	3	39098	62220	64456	51881	0	398	0	0	62220	62220	0	target	0.999878210	target
12	0.9128	4	21421	44371	49616	43431	1500	1061	2194	0	44371	43677	0	non-target	0.690195549	target
13	1.9754	7	71991	96023	103757	95274	0	796	0	0	96023	96023	0	target	0.999739836	target
14	2.2086	11	19334	107359	119276	34235	12300	796	4357	0	107359	115302	0	target	0.999878229	target
15	1.9754	7	71991	96023	103757	83720	0	929	0	0	96023	96023	0	target	0.999878335	target
16	1.3441	6	29429	65336	72132	35835	0	265	0	0	65336	65336	0	target	0.999878210	target
17	2.5349	6	87674	123220	126912	107181	0	928	0	0	123220	123220	0	target	0.999878210	target
18	0.6739	3	19443	32758	37829	24165	0	133	4357	0	32758	28401	0	target	0.999878210	target
19	0.6739	3	19443	32758	37829	21021	0	265	0	0	32758	32758	0	target	0.999878210	target
20	0.6593	2	17162	32048	38881	18413	0	398	0	0	32048	32048	0	target	0.999872796	target
21	0.6593	2	17162	32048	38881	19337	0	398	0	0	32048	32048	0	target	0.999872796	target
22	1.8959	8	37104	92159	104532	60166	0	1724	6748	0	92159	85411	0	target	0.999872796	target
23	1.3441	6	29429	65336	72132	54374	0	928	6748	0	65336	58588	0	target	0.999872796	target
24	2.5349	6	87674	123220	126912	101730	0	928	0	0	123220	123220	0	target	0.999878210	target
25	0.7203	3	19353	35013	41648	30879	0	133	839	0	35013	34174	0	target	0.999901310	target
26	1.1727	5	24563	57004	63673	56257	0	530	2194	0	57004	54810	0	non-target	0.801715784	target
27	2.6194	6	85097	127328	135090	104008	0	1061	13109	0	127328	114219	0	target	0.999878210	target
28	0.6739	3	19443	32758	37829	19524	0	133	4357	0	32758	28401	0	target	0.999866484	target
29	0.6739	3	19443	32758	37829	28738	0	530	4357	0	32758	28401	0	target	0.995595886	target
30	0.9128	4	21421	44371	49616	21441	0	265	0	0	44371	44371	0	target	0.999878210	target
31	0.4177	3	2178	20304	25766	6351	0	398	0	0	20304	20304	0	target	0.999860972	target
32	0.6739	3	19443	32758	37829	19555	0	133	0	0	32758	32758	0	target	0.999878210	target

FIGURE 13 Predicted result interface.

After obtaining accurate predictions, we can further use ACL's built-in functions to record possible errors and unreasonable files in the dataset, as shown in Figure14. Finally, for the convenience of the operator's continuous use, ACL provides project creation functions as a sharing and teaching interface, as shown in Figure 15.

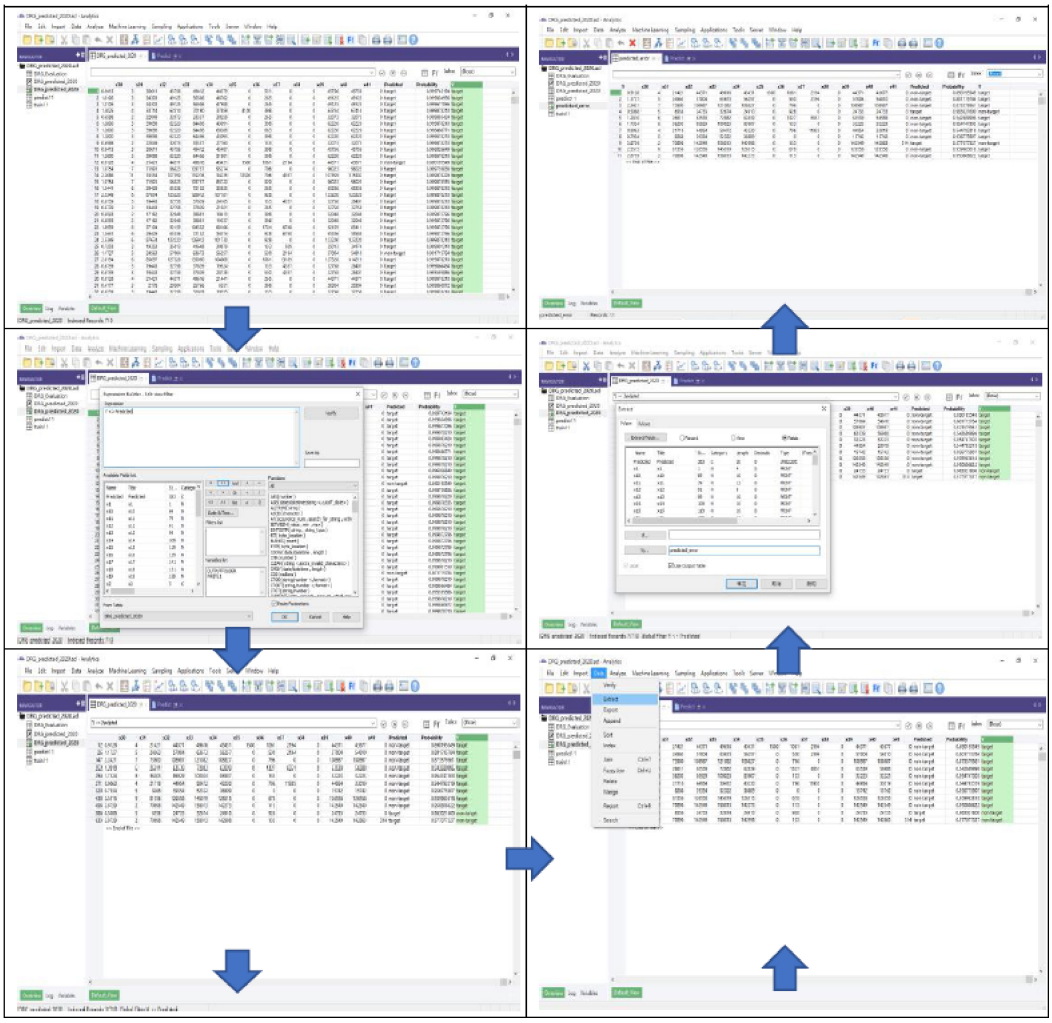


FIGURE 14 Import process flow and navigator of predict set.

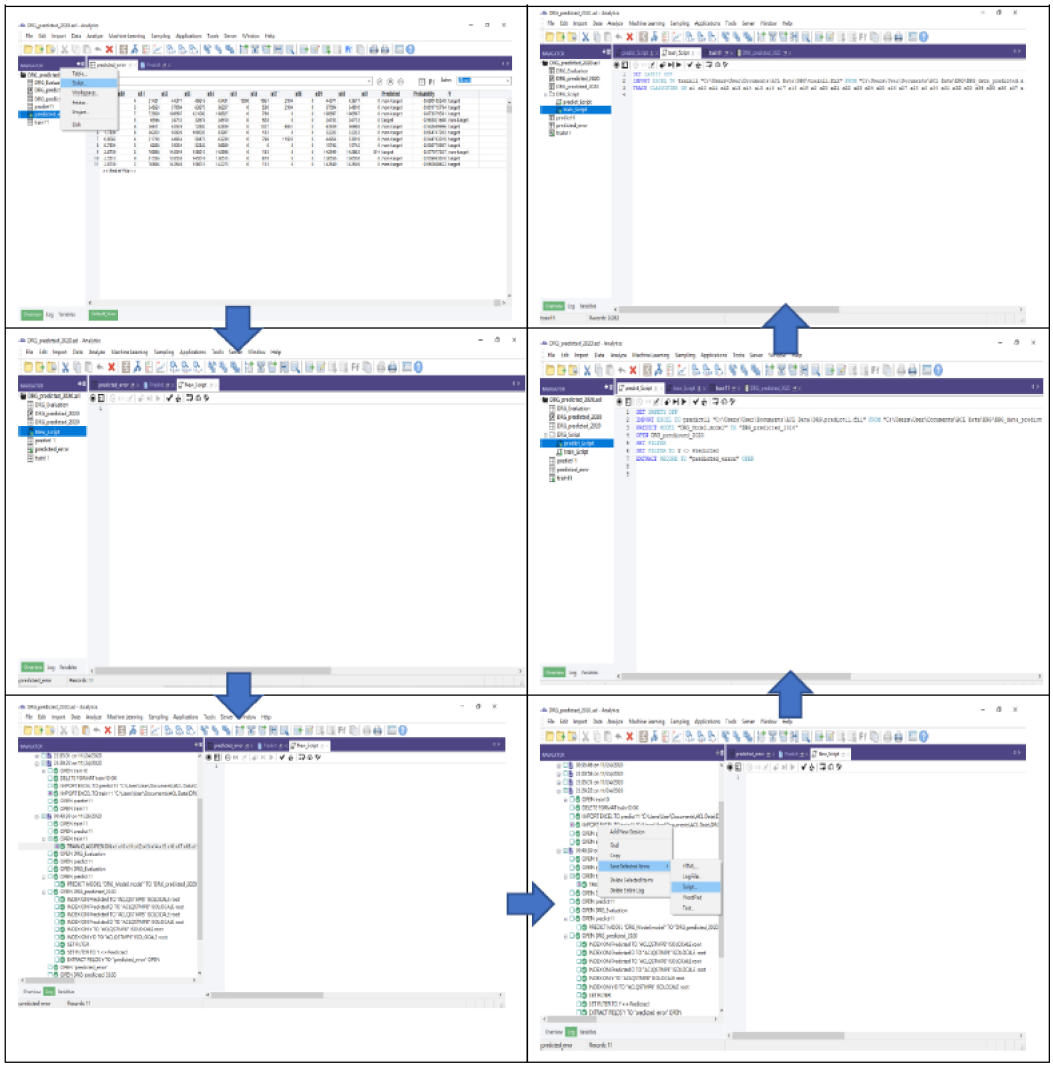


FIGURE 15 Navigator of script for predicted model.

5 | CONCLUSION AND SELF-LEARNING ASSIGNMENT

Students can learn from the above process by performing a self-directed project for predicting accurate drop point of The National Health Insurance Inpatient DRGs. Some assignments that can be used in class are as follows:

Practice 1: Using different fields and scorers to train the Panel_Training_Data and predict the Panel_Predict_Data.

Practice 2: Discussing why most training models predict the "Non-target" result.

Practice 3: Reviewing how to deal with the imbalanced labeled data for the DRG prediction project.

This teaching case aims to increase students' interest in the prediction of the DRG drop point. Moreover, this teaching case uses medical financial management as an example to design the self-learning experiment to assess student learning effectiveness standards and the examples of a related implementation in medical management. The design of teaching cases must include teaching objectives, activity content, implementation methods and procedures, and requirements. Successfully implementing teaching cases relies not only on the teachers' professional experience but also on detailed advanced planning and stimulating students' interest in learning. By combining the real case of medical management with machine learning in the hospital, the design of this teaching case aims to provide students with forward-looking and innovative teaching, which can trigger their willingness to understand and continue an in-depth discussion on issues related to business management.

6 | NOTES FOR THE INSTRUCTORS

When using this teaching case in the classroom, we recommend that students read the relevant course materials, especially the applications of machine learning in the field of accounting and auditing, before performing their analyses. The following are some of the articles recommended for students:

1. The New Public Health Third Edition. In The New Public Health Third Edition (pp. 1-884). (Tulchinsky, Varavikova, & Bickford, 2014)
2. General Supply Warehouse: A Case Study in Internal Control Assessment and IT Auditing Software, International Journal of Computer Auditing, Vol.1, No.1, pp.26- 63. (Hall, J. & Ziltz, K., 2019)
3. Research analysis on emerging technologies in corporate accounting. Mathematics, 8(9), 1589.(Abad-Segura & González-Zamar, 2020)

Machine learning is an area of computer science that learns from large amounts of data, identifies patterns, and makes predictions about future events. In the past few years, machine learning has been increasingly used in the accounting and auditing professions (Ucoglu)

Technological developments, such as machine learning, which enable the processing of data rapidly and without any errors or bias have been widely employed in several areas. Thus, the potential for machine learning algorithms to provide accountants and auditors with enhanced data analysis is high. Machine learning tools designed by humans can perform many tasks that can help auditors and accountants. For instance, instead of sampling data, an entity's entire ledger can be audited using automation. (Shimamoto, 2018)

In the future, accounting and auditing will go through more significant changes due to machine learning, artificial intelligence, big data usage, blockchain, and other technological developments, and will be increasingly supported by automation. (Türegün, 2019)

Song et al. (2014) studied how to assess the financial statement fraud risk by applying machine learning methods. Their

experimental results, obtained from implementing a back-propagation neural network, C5.0 decision tree, logistic regression, and a support vector machine, demonstrated that non-financial risk factors and a rule-based system led to lower error rates. Thus, they concluded that the proposed approach could decrease the financial risks of stakeholders. (Song, Hu, Du, & Sheng, 2014)

Most accounting and auditing tasks have a mechanic and repetitive nature, making them suitable for machine learning applications (Zemankova, 2019). New technologies, such as machine learning, have given rise to different ways of accomplishing tasks, which has also affected the accountancy and auditing professions. Despite its drawbacks, the use of machine learning has many advantages, such as increased efficiency and effectiveness owing to faster data analysis, high quality audit, error reduction, early identification of risks, and creating a competitive advantage. This rapid transformation of the accounting and auditing professions has created a need for ethical governance in terms of implementation. Additionally, regulatory guidance and oversight are also required for machine learning and artificial-intelligence tools used in the processes of accounting and auditing companies. (Munoko, Brown-Liburd, & Vasarhelyi, 2020)

Medical technology and computer communication industry obtain the advancement of information technology. The smart hospital has gradually received attention. Various medical institutions have also begun promoting smart medical care from the early electronic medical records to the current big data applications, such as smart wards, smart halls, bedside service system, wearable device applications, and robots.

The World Health Organization (WHO) provides the following definition for all the smart healthcare (eHealth): "ICT is related applications in the medical and health fields, including medical care, disease management, public health monitoring, education, and research." In the past, medical managers must manually complete all performance report consolidation and accounting tasks. Then, they are also committed to finish the complex and error-prone data collation manually. If a hospital can develop a set of smart reports for the reporting needs of the administrative unit or the reporting needs of the National Health Insurance Agency, users can generate the required reports on their own. In addition to immediately obtaining the required information and making predictions, a win-win situation and maximum benefit can be achieved for the national health insurance costs and the public's medical rights.

With the improvement of computing power, AI technology based on deep learning has made breakthroughs. AI technology can imitate the human brain to make a certain degree of logical and illogical judgments in many fields; it can eventually make human-like decision-making judgments. In the case of large amounts of data with good quality, AI algorithms can achieve excellent results. However, fewer data and more data errors will result in computer "wrong learning," thereby giving poor results. In addition, compared with "rule-based" intelligent coding, the interpretability of AI models is not strong, which is also a major reason for the limitation of AI in many medical applications. Therefore, the most ideal medical record homepage auxiliary coding is based on medical knowledge and is established through AI algorithms. Such a system can not only retain strong medical interpretation but also obtain high efficiency and scalability of AI algorithms. The coding process not only involves medical-related knowledge but also requires the coding personnel to have a certain logical judgment ability. For example, a suitable diagnosis can be selected as the main diagnosis from a plurality of discharge diagnoses, or when faced with multiple diagnosis information, the diagnoses that can be combined can be appropriately coded and combined. Under this premise, machine learning and deep learning algorithms can assist this link to a certain extent. With the gradual advancement of the DRG payment method reform, the accuracy of coding needs to be paid close attention to. Many informatization manufacturers in the market have also begun paying attention to the technical realization of intelligent auxiliary coding.

With the gradual advancement of AI technology, intelligent auxiliary coding from electronic medical record data based on AI technology will have a broader prospect. According to international experience, accurate clinical and cost data are the necessary condition for successful DRG payment in various countries. Therefore, when implementing the DRG payment system, all countries will set up special departments to collect, process, supervise, and review data. DRG involves a series of highly specialized key technical links, such as coding, medical records, grouping, weight and rate calculation, and quality supervision. Judging from the status of talents in Taiwan, the training of professionals in different fields must be strengthened continuously. The construction of a continuous training mechanism guarantees a professional talent for the sustainable development of the DRG payment system reform. Especially in the district and small regional hospitals, the quality of data has been low for a long time and urgently needs to be improved. This low quality is due to the low level of hospital informatization, lack of professional medical records and coding talents, and clinicians not paying enough attention to clinical data, especially the accuracy of coding. To ensure the accuracy and efficiency of DRG grouping, medical institutions must quickly improve coding accuracy through professional training and informatization methods such as intelligent coding.

Finally, we have made some suggestions and implications for the instructors to better understand the significance and association of the teaching case in auditing/accounting information systems courses.

1. What an instructor needs to do before using the case?
   Teachers need to understand the computer audit software-ACL data analysis software before class. The purpose of this lesson plan is to teach students to be familiar with ACL software, to import data, data search, big data analysis, machine learning and visual reporting, and convert daily data into decision analysis data.
2. What is the suggested approach when using the case?
   To familiarize students with the use of ACL software for data import, data search, data analysis and machine learning, it is recommended to guide the actual machine operation step by step in detailed steps.
3. What is the suggested approach when using the case?
   To familiarize students with the use of ACL software for data import, data search, data analysis and machine learning, it is recommended to guide the actual machine operation step by step in detailed steps.

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INTERNATIONAL JOURNAL OF COMPUTER AUDITING

Commentary

A Fast Adoption Methodology of Continuous Auditing in an SAP ERP Environment

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Continuous auditing is a strategic information system that uses data analytic technology, allowing enterprises to automate control examination, risk assessment, and compliance. However, this remains challenging for the internal audit department when adopting the new technology. This paper will discuss a continuous auditing fast adoption methodology in the systems applications products (SAP) enterprise resource planning (ERP) environment. In addition, it will discuss two industry case studies and describe the life cycle of the adoption of the new technology as a lesson learned.

KEYWORDS
Continuous Auditing System, CAATs, Data Warehouse, SAP, Technology Acceptance Model (TAM)

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1 | INTRODUCTION

What is continuous auditing? Referencing the Institute of Internal Auditors Global Technology Audit Guide 3 definition, continuous auditing is the combination of technology-enabled ongoing risk and control assessment. Furthermore, computer-assisted audit techniques (CAATs) are the nucleus of continuous auditing [1]. The systems applications products (SAP) enterprise resource planning (ERP) environment is a highly complex system. Therefore, it is unreasonable to require an internal or external auditor to become a professional SAP ERP expert before being allowed to audit data within the SAP ERP. The auditor's duties should focus on objective audit activities. These activities will extract data from SAP ERP and audit data analytic scripts.

I have learned from two instrumental case studies on SAP ERP auditing [2,3]. While both reflect successful cases in the SAP ERP environment, I have also heard of many cases reflecting failures. Therefore, before discussing this paper's methodology, some technology adoption theories from academia will be highlighted. When discussing how people can adopt or accept new technologies, one model is called the technology acceptance model (TAM), developed by David in 1989 [4]. It shows how people adopt a new technology or IT system. The beginning of the adoption path is perceived in terms of usefulness and ease of use. Therefore, facilitating the adoption of the technology, such as a continuous auditing system, requires making the system as easy to use as possible, and the adoption methodology needs to demonstrate its usefulness as soon as possible.

The other model is the unified theory of acceptance and use of technology (UTAUT) model [5]. It aims to explain users' intentions to use an information system and subsequent usage behavior. The theory holds that there are four key constructs: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions. Several accounting professors, including those from Miami University, Rutgers University, and Pittsburgh University, use the model to assess the successful critical factors surrounding the adoption of continuous auditing systems [6,7].

It is important to determine whether people want to adopt the new technology. The two models represent one kind of checklist to help understand the client's mindset. Without a useful and easy-to-use continuous auditing system, it will be difficult for persons to adapt and continue using new technologies.

Investments in continuous auditing systems are essential for enterprises. It is also important to understand an enterprise's perspective in deciding whether to invest in this form of IT. Dr. Huang [8] discussed the relationship between a firm's IT investment and its performance. It is interesting to see whether the IT-enabled intangible asset will drive the firm's performance, such as its return on assets (ROA) and return on sales (ROS). The firm's IT infrastructure and human–IT resources will drive its IT-enabled intangible assets. This research highlights that adoption is not only in terms of infrastructure but also training.

2 | THE TOOLKITS OF ADOPTION METHODOLOGY

Figure 1 shows the toolkits for our fast adoption methodology for a continuous auditing system, influenced by the above literature review. The components of the infrastructure should be easy to use and useful. Therefore, this study has designed three different toolkits: one is the continuous auditing platform called Jacksoft Toolkit for Auditors (JTK); the second is the auditing data warehouse, called JADW; the third is audit robots, called JBOTs and also the audit dashboard, ensuring its ease of use and usefulness to auditors. In addition, a robust training method is required for CAATs for human–IT resource components, such as the International Computer Auditing Education Association's International Certified CAATs Practitioner (ICAEA ICCP) courses and certificates, the Certified ERP Audit Professional (CEAP) for SAP ERP training courses and certificates [9].

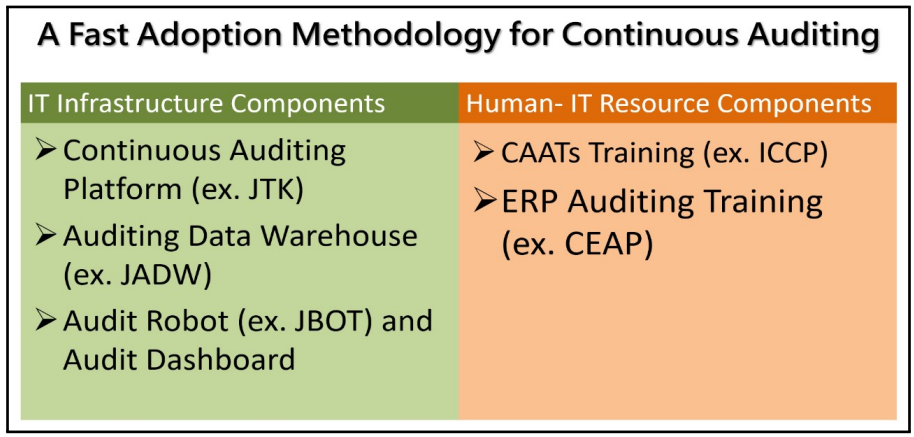


FIGURE 1 The toolkits of continuous auditing adoption)

Figure 2 shows the architecture for JTK [2]. Auditors can design many of their scripts by using audit common language (ACL). Following the structure of the JTK, these scripts can be combined to become a JBOT. It can be run continuously, 24/7, and automated to notice the warning message to the audit activity in charge. Most auditors have an easy-to-use web interface. As a result, auditors can easily share audit findings, collect evidence and do risk analytics.



FIGURE 2 The architecture of JTK–Continue Auditing Platform [2])

The second infrastructural component is an audit data warehouse [2]. It is the most challenging part for auditors to manage data and build an audit data warehouse. In this regard, JADW has a robust platform to assist with the entire audit data dictionary. The dictionary can help auditors develop new scripts and understand data. The data robot will do the physical data extraction tasks.

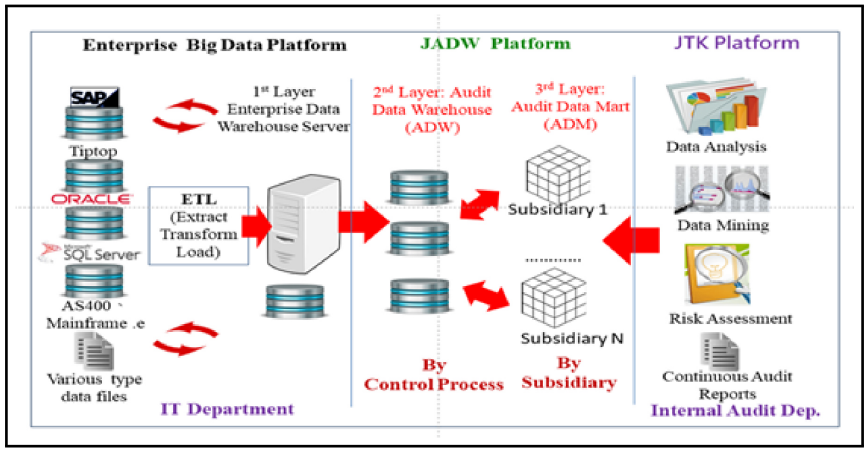


FIGURE 3 The architecture of JADW [2])

The third component is audit robots and the audit dashboard. The audit robot is a combination of audit scripts. Standard audit robots, called JBOTs, allow auditors to install them into a continuous auditing platform. Auditors can also build audit robots and install them into the continuous auditing platform. The audit robots will import the data from the audit data warehouse, analyze the data, and generate the audit finding. The finding is not only for the audit report but also for use in the audit dashboard. The audit dashboard will enable auditors to analyze the risk easily and evaluate which controls require their focus.



FIGURE 4 The architecture of JBOT and Audit Dashboard

Human–IT resource components are essentially focused on training, which is one of the critical success factors for the methodology. Auditors need to become competent in human-IT resources by accessing the ICAEA computer auditing training and certification exams.

3 | THE FAST ADOPTION METHODOLOGY

Figure 5 shows the three phases included in this study's fast adoption methodology. Phase one is called Fast Forward, where an interview is conducted to understand organizational audit objectives. Next, suitable standard JBOTs are installed to meet the audit objectives. Then, the organization is assisted in developing a standard SAP ERP audit data warehouse. Auditors can run the JBOTs and put them into a schedule. After seeing the result, we come to the information and communication step, which involves engaging in discussions with auditors to evaluate the audit finding. This phase allows for focus on the audit objective and avoids much noise in the communication channel since auditors can see the result. This phase also makes auditors think that the continuous auditing system is easy to use and useful.

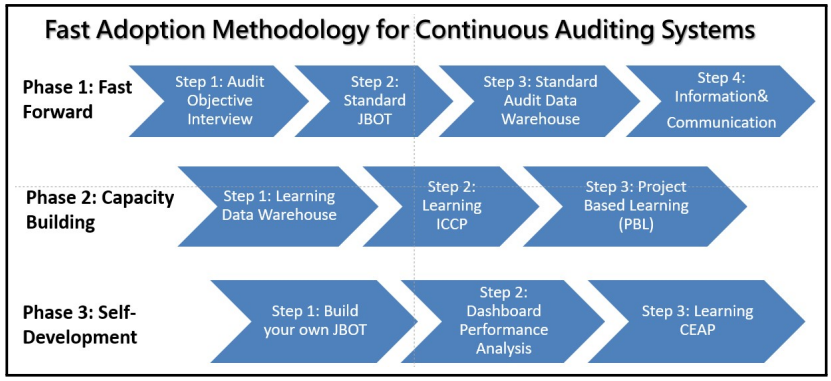


FIGURE 5 The fast adoption methodology for continuous auditing systems

The second phase is called capacity building, which is focused on the training. Auditors must be taught how to use audit data warehouses and CAATs. In the third step, auditors are organized to form different teams for audit projects. The project-based learning method enables auditors to gain practical knowledge and skills.

The third phase is called self-development, where an auditor learns to create an audit project. Then, they must apply these skills to audit tasks. In this phase, consultants will like a coach to answer the auditors' questions and assist them in figuring out the data problems. Finally, auditors will finish the project by themselves and install their scripts into a continuous auditing platform, such as JTK. They can join the advanced SAP audit course and join the CEAP certificate exam if they aim to become a professional SAP auditing expert.

4 | CASE STUDIES

The paper will explore two cases that adopted the continuous auditing system between 2020 and 2021. The first case is an IT industry company in Taiwan. This company uses SAP ERP and has a subsidiary in China and Japan. The company's revenue is about 2.7 billion USD, and it hires about 9000 to 10,000 employees. The ERP location is in southern Taiwan.

After interviewing the chief audit officer, the case selected an SAP accounts payable audit bot, which includes 16 scripts, and an SAP Vendor audit bot, which includes 39 scripts as their standard JBOTs to fast forward the adoption process. The standard SAP audit data library has been installed into JADW. There are five main elements of data contained in the tables were extracted from the SAP into the audit data warehouse. They were scheduled to import these data monthly. The largest table is BKPF, which has about six million transactions. The fast forward enables auditors to see the audit findings within two weeks, after which they begin discussing the reliability of the findings. After several parameters are justified, auditors accept the findings and perceive the system as easy to use and useful. Then, auditors begin taking the training courses. Fifteen people attended ICAEA courses, and 13 people passed the ICCP.

After one year, the company has 144 audit scripts. Beginning with 55 audit scripts, the auditors designed 99 audit scripts by themselves. Furthermore, the control coverage is from two to three modules. They analyze how to control risk in different modules or different locations and departments. As a result, they have saved several unnecessary payments and cost down several procurement cases. The continuous auditing system has become their IT-enabled intangible asset.

The second case is one of a top-10 manufacturing company in Taiwan. Its revenue is about 10 billion USD, and it hires about 11,000 to 12,000 employees. The enterprise has several ERPs. SAP ERP is one of the major information systems used in its China branch.

We start discussions with the client through remote zoom meetings due to the COVID-19 situation. In this regard, the client selects the JBOTs, SAP AP control, and SAP Vendor control. The fast forward enables auditors to see the audit finding within two weeks. IT persons have expressed shock at the findings revealing duplicate or phantom vendors. The process is a remote auditing process. Furthermore, auditors take a distance learning and online certification exam.

After three months, the company has 72 audit scripts. The control coverage ranges from two to four modules. They are using the dashboard to analyze their risk and recover several losses. Moreover, the continuous auditing system has become their IT-enabled intangible asset.

5 | CONCLUSION

I want to share my experience on "A good adoption methodology need[ing] to have several toolkits and good training courses". The two cases use the fast adoption method, spending two to four weeks to generate the audit finding from the continuous auditing system. The project is separated into 30% effort in the data warehouse, 40% in the script design, and 30% in training. I am thrilled to see my clients' continuous training in their JBOTs, adding serval new elements of audit knowledge into the JBOTs, and co-working with JBOTs in their daily audit jobs. CAATs self-efficacy of auditors is the driving force for continuing to generate IT-enabled intangible assets. The JBOT becomes smart, and the auditor becomes a man of value.

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INTERNATIONAL JOURNAL OF COMPUTER AUDITING

Commentary

The Emerging Technologies and Trend in Computer Auditing

ICAEA Professional Development Team, Canada

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New Accountant Era: "CPA Exam Revisions Focus on Tech, Critical Thinking"

The American Institute of Accountants (AICPA) and the National Association of State Boards of Accountancy (NASBA) have established a joint working group to carry out a larger "CPA Evolution" project since 2018. Begin to discuss about whether Accountant Licensure Regulation is reformed against the current capability that the accountant needs, such as technology capacity and information analysis. AICPA has also conducted a "practice analysis" (practice analysis) project plan (referred to as AICPA 2019) since 2019. Both mainly discuss accountant examination in response to rapid development of technology, audit analysis and process automation these years. According to the study, Accountant licensure urgent needs a new model to handle artificial intelligence, automation, data analysis and digital mindset [1].

It is also interesting to see the change from professional site. As you may know that the AICPA CPA Exam will change to reflect the new, technology-focused reality of the profession on 2021. The exam will test more on concepts like IT controls, automation, and business processes — and less on topics like IFRS and U.S. GAAP. With these changes fast-approaching — and an even bigger overhaul coming in 2024 — current and prospective CPAs likely need to hone skills like data analytic and digital mindset.

From the above analysis, we can see the competency of new CPA and accounting students will be much different to know. It looks like that CPA firm will face a big challenge for these new talent in now or the several coming years. COVID-19 has pushed CPA clients to have better IT environment and controls. It is soon that CPA firms will need to do IT investment in their environment and their talent CAATs skill.

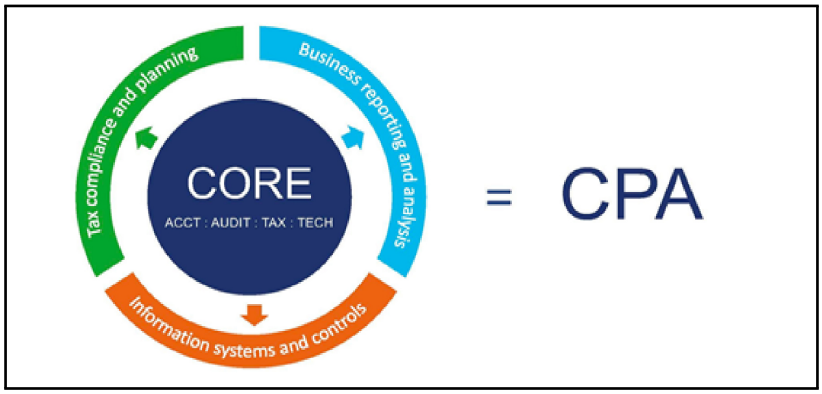


FIGURE 1 CPA Licensure Model [1]

New Era of International Certified CAATs Practitioner (ICCP)

The International Computer Auditing Education Association (ICAEA), based in Vancouver Area, Canada, has promoted the cultivation of technology and critical thinking for auditors over a decade. ICAEA thanks for the new CPA, Exam Revisions and believe that the changes will not only in North America but also globally. Many countries will undergo similar transformation for the modern accountant revolution. In the future, ICAEA certificate exam will still emphasize the parallel of the Knowledge and Case Study Hands-On [2].

ICAEA believes that computer auditing is a work which requires social practice, so the relevant competency is not only theoretical but also a need for practical technology skill. The ICCP competency framework (see Figure 2) is the basic standard for all auditors when providing audit services by using CAATs. As the change of technology knowledge is ten times faster than the change of traditional accounting knowledge, relevant professionals need to continuously improve their competency to meet the new world requirement. The practice of a good auditor begins primarily in the study of the computer auditing program and in the preparation of an auditor with high efficiency information technology skills in auditing.

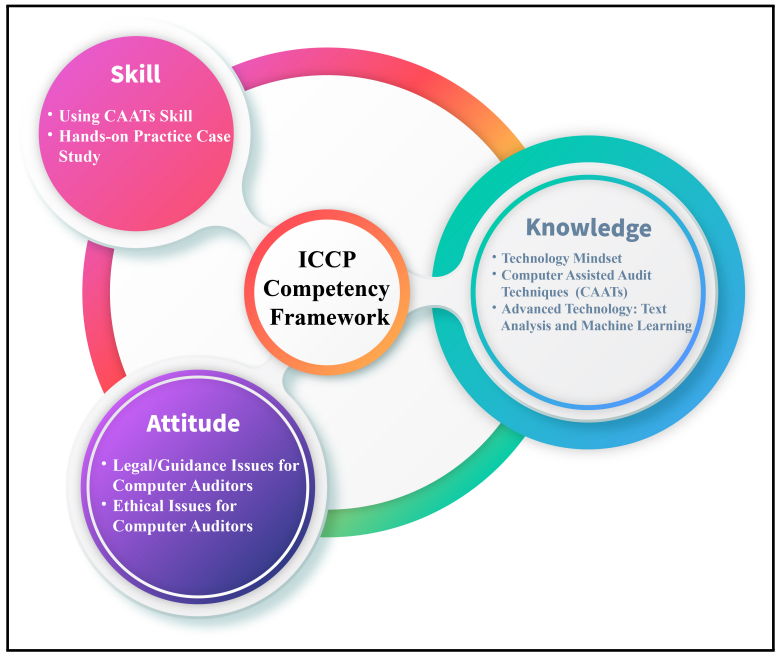


FIGURE 2 ICCP competency Framework

The framework defines by KAS model (Knowledge, Attitude, Skills). It is the standard for the practice of data analysis and is for professionals who perform auditing tasks. Recognized globally as the standard of CAATs Practitioner, it guides auditing professionals within the three core knowledge areas, focused on various Standards, Specific Auditing Functions, and Key proficiencies, with three distinct competency levels that progress from general knowledge, and finally expert practitioner. In the future, ICCP examinations will add the emerging machine learning technology and IT control/governance technology testing items, such as Predictive Analytics, Cybersecurity risk, Open Data Extraction, etc.

Despite the uncertainty the global pandemic has impact audit process, remote or online learning has been definite trends are emerging for the year ahead. ICAEA certification exams will provide remote on-line examination methods. Anyone who is interested in this field can have online exams to confirm what they learned have met the basic needs of practical work.

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INTERNATIONAL JOURNAL OF COMPUTER AUDITING

New Technology

Introduction to Blockchain in Accounting and Auditing

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Blockchain is one of the popular emerging technologies that interests academic researchers and practitioners in the recent decade in various business domains, such as supply chain (e.g., Saberi, Kouhizadeh, Sarkis, and Shen 2019), finance (e.g., Tapscott and Tapscott 2017a), marketing (e.g., Tapscott and Tapscott 2017b), accounting (e.g., Liu, Wu, and Xu 2019) and auditing (e.g., Dai and Vasarhelyi 2017). Its *decentralized*, *persistent*, *transparent*, *traceable (auditable)*, and *immutable* characteristics, supported by the underlying mechanisms of cryptographic hash functions, asymmetric-key cryptography, and different consensus mechanisms (Yaga, Mell, Roby, and Scarfone 2019; Zheng, Xie, Dai, Chen, and Wang 2017), make it excellently applicable to information-sharing and transaction-recording activities. Bitcoin, designed by Nakamoto (2008), might be the most well-known application of blockchains, indirectly thriving other digital asset ecosystems[1] , decentralized applications (DApps)[2] , non-fungible tokens (NFTs), central bank digital currencies (CBDCs), and other blockchain applications.

The development of blockchains could be depicted as three main phases: Blockchain 1.0, 2.0, and 3.0 (Swan 2015; Xu, Chen, and Kou 2019). Blockchain 1.0 is applications related to digital currencies (such as bitcoin) intended to create decentralized payment systems. Blockchain 2.0 has a broader scope containing applications built by smart contracts in the finance area, including DApps, decentralized autonomous organizations (DAOs), etc. Blockchain 3.0 includes applications beyond finance such as natural science and healthcare and token-based ones (Swan 2015). Blockchains are continuously growing and evolving.

Consensus mechanisms of blockchains plays an important role in blockchains' performance, operation efficiency, and security. Popular consensus algorithms include Proof of Work (PoW), Proof of Stake (PoS), Delegated Proof of Stake (DPoS), Practical Byzantine Fault Tolerance (PBFT), and Raft (Du, Ma, Zhang, Wang, and Chen 2017). Furthermore, Blockchains can be classified into *permissionless (public)* and *permissioned (consortium* and *private*) ones based on the

[1] For example, Ethereum is another well-known blockchain platform that support tremendous decentralized applications. More information is available at its official website: https://ethereum.org/en/

[2] Decentralized finance (DeFi), decentralized exchange (DEX), and decentralized gaming are examples.

level of participant restriction (Zheng et al. 2017). Bitcoin and Ethereum (MultiChain[3]) are examples of permissionless (permissioned) blockchains.

Blockchain Applications in Accounting and Auditing

Blockchains, with their auditability, have many applications in the accounting and auditing. For instance, Liu, Wu, and Xu (2019) discussed the impacts of blockchains on the audit practice and the challenges and opportunities from permissioned and permissionless blockchains on auditors. Moreover, Dai and Vasarhelyi (2017) envisioned that blockchains *"could enable a real-time, verifiable, and transparent accounting ecosystem"* and have *"the potential to transform current auditing practices, resulting in a more precise and timely automatic assurance system."* Different from those concept-oriented academic papers, the "financial blockchain confirmation platform" was designed and practically implemented in Taiwan to facilitate the efficiency and effectiveness of bank confirmation process starting from 2018 (Wang and Chen 2021)[4] . The empirical evidence indicated that the days of bank confirmation (from 14 days to 0.5 to 3 days) and the re-confirmation rates (from 25% to 0.37%) are significantly decreased after the implementation (Wang and Chen 2021).

Some scholars envisioned that smart contracts could be implemented and integrated into the future financial statement audits. For example, Rozario and Vasarhelyi (2018) proposed that the smart audit procedures (a new type of audit data analytics), enabled by smart contracts and performed in blockchain environments, could be *autonomously* implemented to address different audit risks and have the potential to realize the close-to-real-time audit reporting. Also, Rozario and Thomas (2019) proposed the concept of *interlinked* blockchain ecosystems composed of the *external audit* and the *business* private/permissioned blockchain ecosystems in which smart audit procedures could be performed. Specifically, auditors would participate as a node on the business blockchain with read-only access to ensure they have the *population* of audit relevant information stored on the blockchain and load it to the external audit blockchain. After that, the pre-determined smart audit procedures (including smart internal control tests, smart test of details, and smart analytics) could be performed *autonomously*, designed to detect material misstatements. Auditors can also share relevant information to stakeholders, such as the PCAOB, the SEC, and the audit committee on the external audit blockchain.

There are some literature review papers summarizing the concept and ideas of blockchains in the accounting and auditing domain (e.g., Secinaro, Dal Mas, Brescia, and Calandra. 2021; Schmitz and Leoni. 2019; Yu, Lin, and Tang 2018). Those reviews provide readers with the proposed frameworks and approaches, the current findings and envisions, and the potential research topics from different perspectives. In my personal opinion, more empirical evidence after implementing blockchain in the accounting and audit practices would be valuable the community to demonstrate the benefits of blockchains.

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INTERNATIONAL JOURNAL OF COMPUTER AUDITING

News

2021 International Conference on Computer Auditing in Tokyo

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President, Sankei Biz Consulting, Corp., Japan



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Introduction

Due to COVID-19, it is assumed that companies may allow special measures such as emergency response and unprecedented response that cannot be handled by conventional internal control, and there is risks of fraud and errors. It can be said that the opportunities of occurring risks and errors are increasing. For this reason, auditors are required to perform higher quality audits than ever before, and technology-based auditing methods are attracting attention in remote environments.

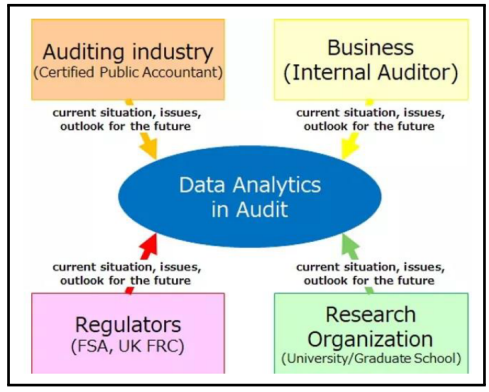
However, there are many futuristic contents such as AI audits which can be seen on the Web etc., and there is very few specific information that can be provided such as how to utilize technology for audits at this time. In addition, it is difficult to collect the directions that regulators and research institutes are thinking in a timely manner, and I thought that there might be needs to know more about "what I should do now".

In order to meet the needs, I aimed to create an opportunity that 2021 International Conference on Computer Audit was held for the purpose of gathering and discussing people from four positions, an audit industry (Certified Public Accountant), regulators (FSA, UK FRC), business world (internal auditor), research institutions (universities / graduate schools). I aimed to create an opportunity that think about "what I should do now" by having people from each position give a lecture on "What is data analysis in auditing and how will it be developed in the future?" We would be happy if we could provide such an opportunity to everyone who watched it.

September 2021
International Computer Auditing Education Association of Japan
Representative Director Keiji Yumiba

1 | CONFERENCE CONCEPT

2021 International Conference on Computer Audit will be held for the purpose of gathering and discussing people from four positions, an audit industry (Certified Public Accountant), regulators (FSA, UK FRC), business world (internal auditor), research institutions (universities / graduate schools). These four positions are all interested in utilizing IT, including computer audit education and data analysis.
The concept is below
"Understanding the current status, challenges, and future of data analysis in auditing,including overseas. Understanding Data Analysis in Auditing from Four Positions "
We would like to achieve our aims which it is for attendees to understand that "What you should do now by understanding the current situation, issues, and the future direction of Data Analysis in Auditing".
We try to be an open information sharing place in order to achieve above aims.



I believe that it was an opportunity for the participants to understand the current situation, issues, and future direction of "data analysis in auditing" and to think about "what I should do now".

2 | CONFERENCE SUMMARY

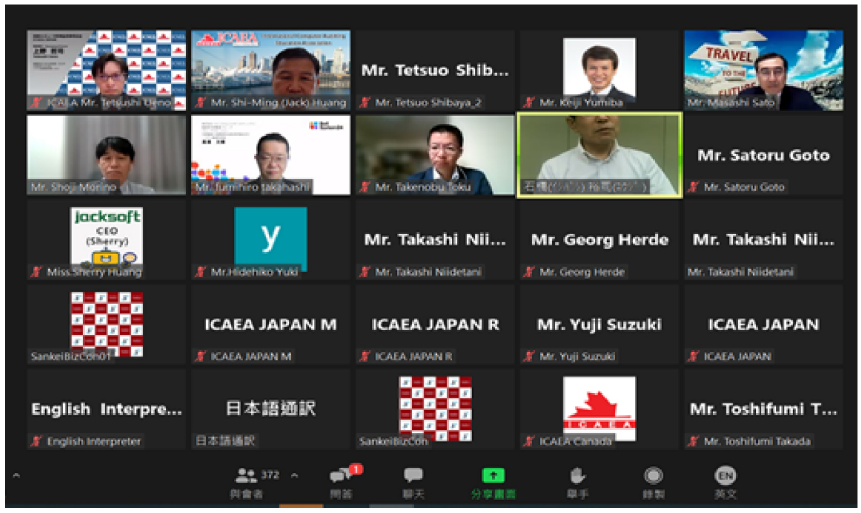
- Date: September 10, 2021, 10: 00-18: 00
- Venue: Zoom Webinar (with simultaneous Japanese / English interpretation)
- Theme

  Understand the current status, issues, and future of "Data Analysis in Auditing"
  -Understanding "Data Analysis in Auditing" from four positions (*)-
  * Audit industry (Certified Public Accountants), regulators (Financial Agency, UK FRC), Business world (internal auditor), Research institutes (university / graduate school)

- Significance of participation

It will be an opportunity to think about "what I should do now" By grasping the current situation, issues, and future direction of "data analysis in auditing" including overseas.

- Photos of The 2021 International Conference on Computer Auditing event



3 | PROGRAM LIST

Time	Title	Speakers
10 : 00～ 10 : 05	Opening remarks	Mr. Keiji Yumiba ICAEA JAPAN Representative Director
10 : 05～ 10 : 25	Evolutionary direction and technology that audit should aim for	Mr. Masahiko Tezuka The Japanese Institute of Certified Public Accountants Chairman and President
10 : 25～ 10 : 35	Computer Auditing: The way forward after COVID-19	Mr. Shi-Ming (Jack) Huang ICAEA International Chairman National Chung Cheng University, Taiwan Dean/Professor
10 : 35～ 10 : 45	World Computer Auditing Awards	Mr. Shi-Ming (Jack) Huang ICAEA International Chairman National Chung Cheng University, Taiwan Dean/Professor
10 : 45～ 11 : 15	Technological Resources, Using Technology to Improve Audit Quality	Mr. Jason Bradley The UK's Financial Reporting Council (FRC) Project Director, Audit & Assurance Policy
11 : 15～ 11 : 35	Use of Technology to Improve Audit Quality	Ms. Kaori Nishiyama FINANCIAL SERVICES AGENCY(FSA) JAPANESE GOVERNMENT Director for Enforcement of Corporate Disclosure, Policy and Markets Bureau
11 : 35～ 11 : 55	Which direction is better for the audit industry, whether data analysis experts should be trained in auditing, or auditing experts should be trained in data analysis?	Mr. Tetsuo Shibaya Grant Thornton Taiyo LLC, Senior Partner, Head of Audit Headquarters Certified Public Accountant
13 : 00～ 13 : 20	Talents in the audit data analytics market	Mr. Tawei (David) Wang DePaul University, USA Associate Professor and Driehaus Fellow School of Accountancy & MIS
13 : 20～ 14 : 10	The current situation, issues and outlook for the future of "Data Analytics in Audit"	Moderator: Mr. Keiji Yumiba Panelists: Mr. Jason Bradley, Ms. Kaori Nishiyama, Mr. Hidehiko Yuki, Mr. Tetsuo Shibaya, Mr. Takashi Niidetani
14 : 10～ 14 : 30	"Comfortable control" for teleworkers -Utilization for PC	Mr. Fumihiro Takahashi Bellsystem24 Holdings, Inc. Internal Audit

Time	Title	Speakers
	device log	Group Group Manager
14 : 45～ 15 : 05	A Fast Adoption Methodology of Continuous Auditing in SAP ERP Environment	Miss. Sherry Huang Chair, ICAEA Taiwan Chapter CEO, Jacksoft Commerce Automation Ltd., Taiwan
15 : 05～ 15 : 25	Current status and issues of data analysis utilization in internal audit and prospects	Mr. Satoru Goto SanKei Biz Consulting, Corp. Operating Officer
15 : 25～ 15 : 55	The current situation, issues and outlook for the future of "Data Analytics in Audit"	Moderator: Mr. Tetsushi Ueno Panelists: Mr. Fumihiro Takahashi, Mr. Shoji Morino, Mr. Yuji Ishibashi, Mr. Masashi Sato, Mr. Takenobu Toku
15 : 55～ 16 : 15	Post COVID-19, Counter Strategy for Auditing Method Changing	Mr. Chu Bue-geum ICAEA KOREA President Artner Consulting Co., Ltd. Chief Executive Officer
16 : 30～ 16 : 50	Significance of Data Analytics for Auditors	Mr. Toshifumi Takada ICAEA JAPAN Executive Adviser Tohoku University Professor Emeritus National Chung Cheng University, Taiwan Professor
16 : 50～ 17 : 10	Combined Assurance	Mr. Ezz Hatab ICAEA Middle East Chapter, UAE President
17 : 10～ 17 : 30	Artificial Intelligence – A solution for external auditing?	Mr. Georg Herde Business Administration and Business Informatics, Deggendorf Institute of Technology, Germany Professor
17 : 30～ 18 : 00	How can AI Audit affect Auditors' Responsibility ?	Mr. Hiroshi Taki Ritsumeikan University, Japan Professor
18 : 00～ 18 : 05	Closing remarks	Mr. Keiji Yumiba ICAEA JAPAN Representative Director

4 | APPLICATION AND REGISTRATION STATUS

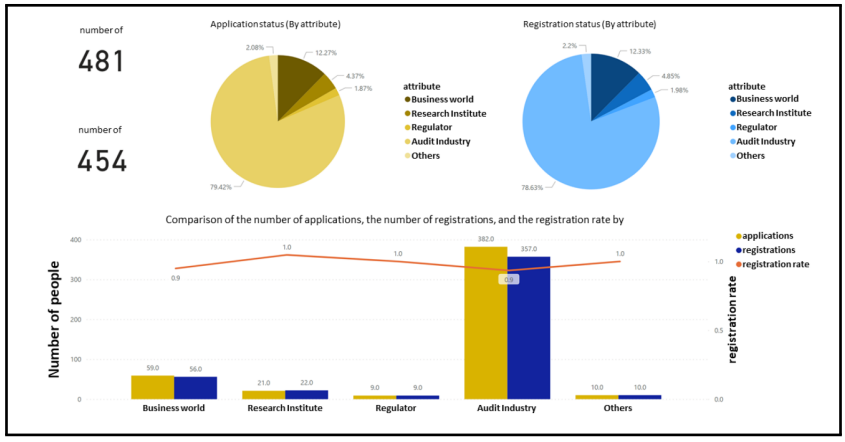
The number of people who applied for the conference, hereinafter referred to as applicants, was 481. Of these, about 80% were applications from the audit industry.

Of the applicants, 454 were registered with Zoom to participate in the conference, hereinafter referred to as registrants. In addition, a total of 438 people participated in the conference, hereinafter referred to as participants.

All applicants from regulatory and research institute were registered, also applicants from audit industry and business world registered more than 90%, as a result, nearly 95% of them registered overall.

Please refer to the graph below for the specific breakdown.

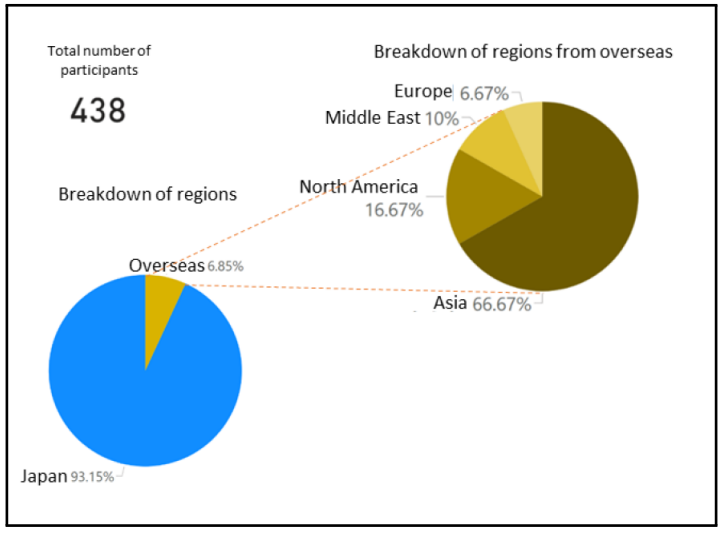
"Attribute" is a questionnaire at the time of Zoom registration, and the answer from "Business world / Research Institute / Regulatory Authority / Audit Industry / Others" about affiliation of applicants.



5 | OVERVIEW OF PARTICIPANTS

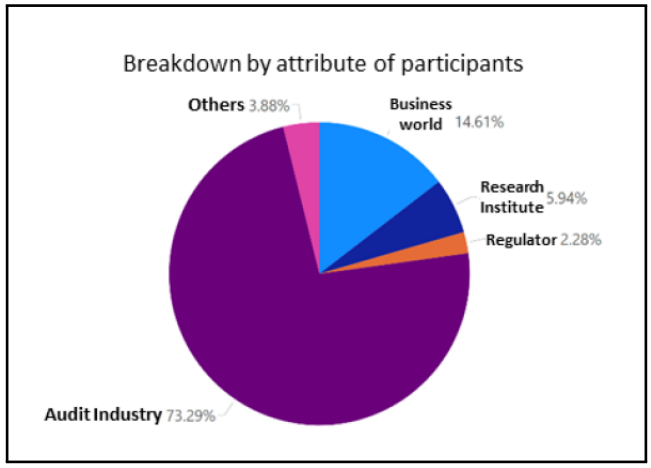
(1) Breakdown by country

Of the participants, 93% were from Japan and 7% were from overseas. From overseas, 9 countries participated, with 67% of the participants from Asia, followed by 17% in North America. 35% of the speakers were from overseas, and they gave lectures on the current situation in their regions.



(2) Breakdown by attribute

Of the 438 participants, about 73% were from the audit industry and about 15% were from the business world. Although the number of participants from research institutes and regulator is not large, it can be said that the conference was attended by people from various positions.



6 | QUESTIONNAIRE ANALYSIS

Participants in the conference were asked to cooperate in the questionnaire at the time of registration, hereinafter referred to as the pre-questionnaire, and after the completion, hereinafter referred to as the post-questionnaire. We have summarized the opinions on the conference from the results of the questionnaire.

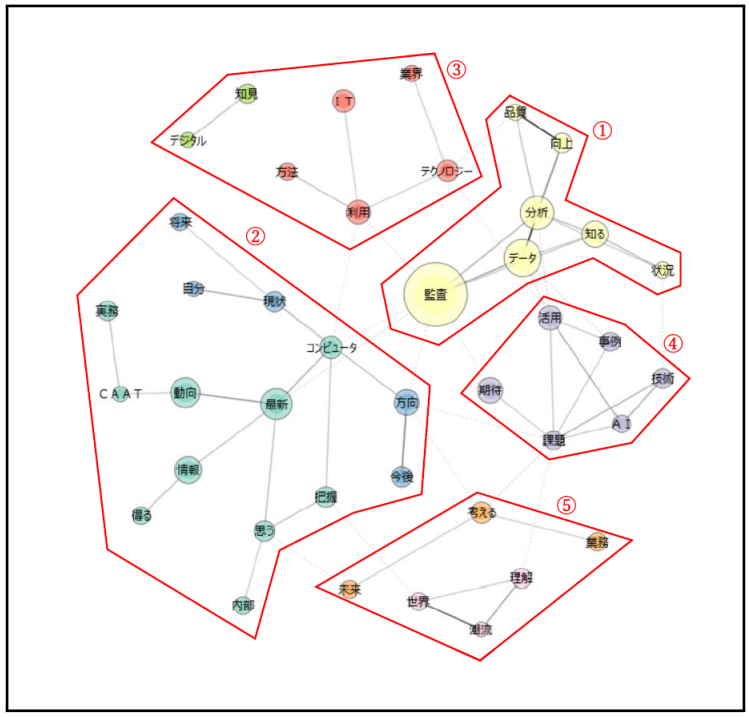
In the pre-questionnaire, participants gave their opinions on the sessions they were interested in, and in the post-questionnaire, they gave their opinions on the sessions that left an impression on them. The number of respondents to the post-questionnaire, hereinafter referred to as the number of respondents to the questionnaire, was 148.

(1) Pre-questionnaire: Expectations for the conference

In the pre-questionnaire, we asked them to write comments about "Expectations for the conference".

Here, the comment was analyzed using the co-occurrence network diagram of the text mining tool "KH Coder". A co-occurrence network diagram is a network like diagram of how "words" are used in similar contexts.

The co-occurrence network diagram of "Expectations for the conference" is as follows.



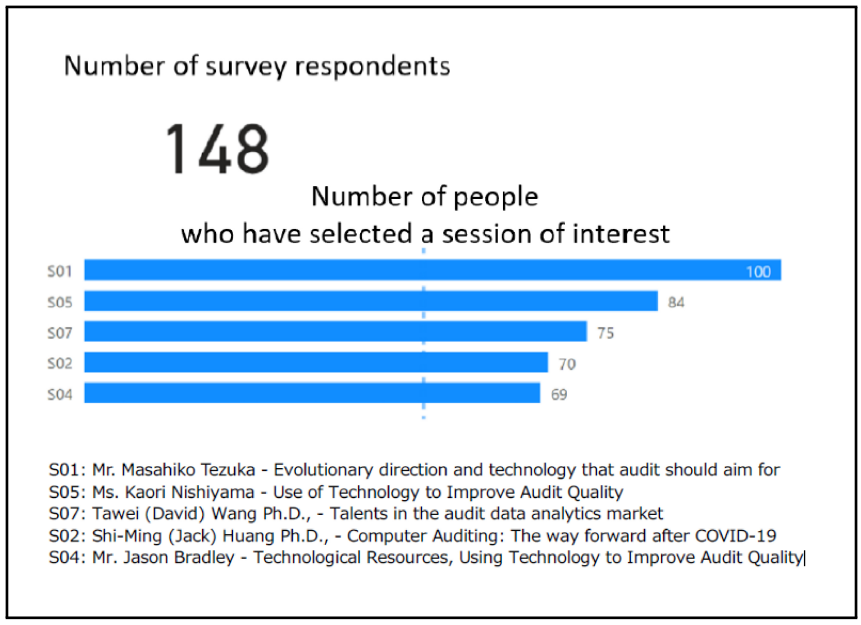
According to the above co-occurrence network diagram, expectations for the conference were described in five major themes.

1. Want to know the status of data analysis in auditing
2. Want to know the latest trends regarding CAATs
3. Want to know information on how to use IT technology in the audit industry.
4. Want to know about issues related to the use of AI in audits and future expectations.
5. Want to know about the world situation and trends

It can be read that each of them wants to be an opportunity to collect the latest information on data analysis in auditing and information on the world.

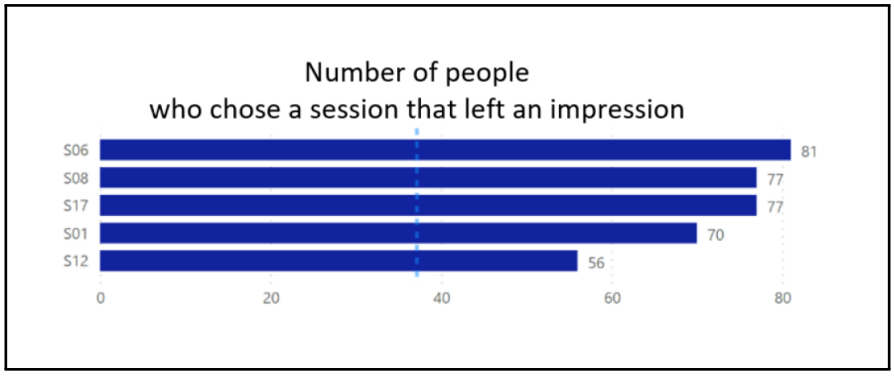
(2) Pre-questionnaire: About "Interesting Sessions"

Of the 17 sessions, the top 5 sessions selected as "interesting sessions" in the prequestionnaire are as follows. Three of the five sessions were sessions of overseas speakers, and it seems that many people were interested in overseas information.



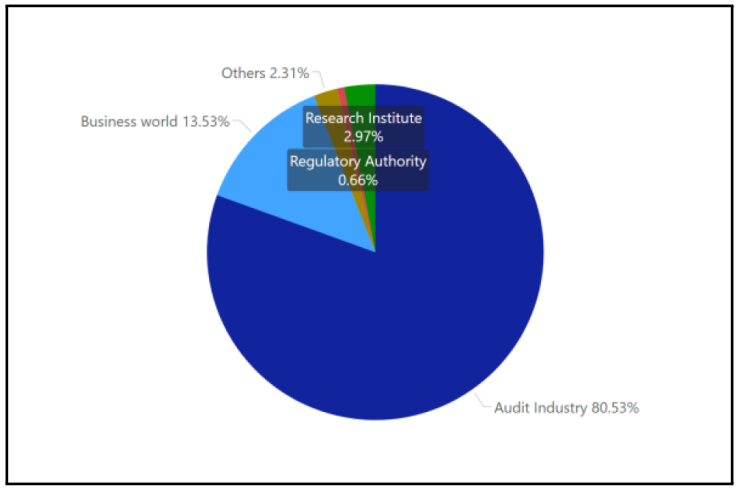
(3) Post-questionnaire: About "Impressive Sessions"

The top 5 sessions selected as "Impressive Sessions" in the post-questionnaire were as follows.



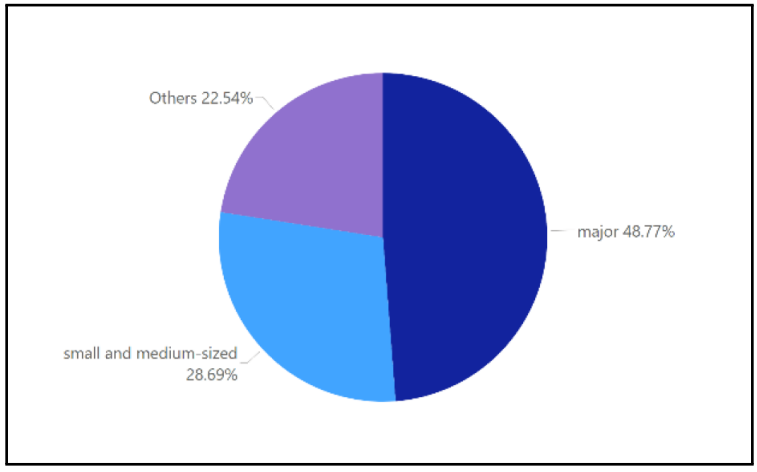
- "S06: Which direction is better for the audit industry, whether data analysis experts should be trained in auditing, or auditing experts should be trained in data analysis?" (Mr. Tetsuo Shibaya)
  This theme is of interest to anyone in the auditing industry, and I suspect it is a trialand-error theme.
  Mr. Shibaya gave an easy-to-understand and polite explanation of the actual efforts and philosophies of the audit corporation to which he belongs, which seems to have left a lasting impression on many participants.
- S08: Panel discussion (presented by Financial Services Agency, Audit Corporation, JICPA, UK FRC) In this session, a panel discussion was held with the participation of regulators, The Japanese Institute of Certified Public Accountants, and audit corporations. We exchanged opinions with panelists on the theme of "How much data analysis is

being used in the audit industry !?" In addition, since the participants' awareness survey was conducted in real time and opinions were exchanged based on the results, I think that the panelists could have made frank comments. The following is a discussion of the content of the awareness survey and the responses of the participants.
A total of 303 people participated in this awareness survey. The classification of participants is as follows.



Participants in the audit industry, which account for 80% of the above categories, have been further subdivided.

Specifically, I classified participants who belong to audit corporations with more than 1,000 partners and employees as "major", participants who belong to audit corporations with less than 1,000 partners and employees as "small and medium-sized", and other participants as "others".



As a result, around half was the "major" participants and around 30% was the "small and medium-sized" participants. The specific ratio is as shown on the right.

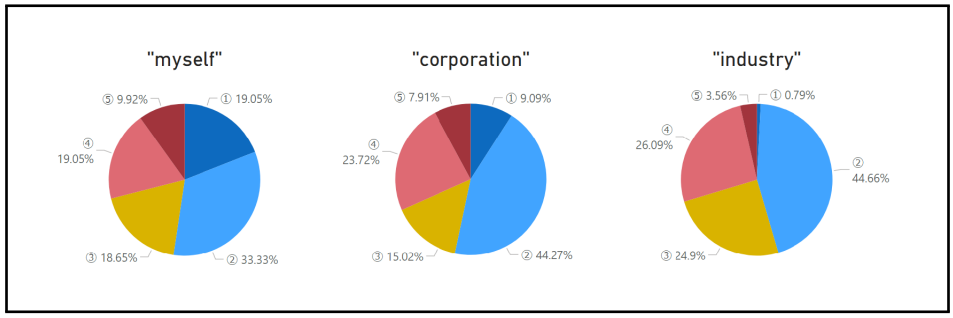
[Q1] How pervasive is the data analysis method in the audit site? hereafter, the degree of penetration of data analysis

Regarding the above questions, there are three levels: "Jobs I am involved in, hereinafter, myself", "Audit corporation / company to which I belong, hereinafter, corporation", and "Whole audit industry, hereinafter, industry". So, we asked them to answer from the choices of "(1) very permeated, (2) permeated to some extent, (3) neither can be said, (4) not so permeated, and (5) not permeated at all."

Since "myself" is the participant's own recognition, it is an index that shows the actual situation, and "corporation" and "industry" are the participants' assumptions, so it is presumed that they are indicators that are close to the actual situation.

In the following discussion, in order to analyze the overall tendency, for convenience, "(1) very permeated / (2) permeated to some extent" is "permeated" and "(3) not so permeated / (4) Not permeated at all" is expressed as "not permeated", and "(5) I can't say either" is expressed as "I don't know".

The answers of all the participants were as follows.



As for the degree of penetration of data analysis, "not permeated" ((4) and (5) in the above figure) was that the participants in all " myself ", "corporation", and "industry" were about 30%. On the other hand, "permeated" ((1) and (2) in the above figure) was that "myself" and "corporation" was more than 50%, but "industry" was 45%, and the decrease was "I don't know" ((3) in the above figure).

It is presumed that this means that "myself" and "corporation" can grasp the actual situation but cannot grasp the actual situation of other companies.

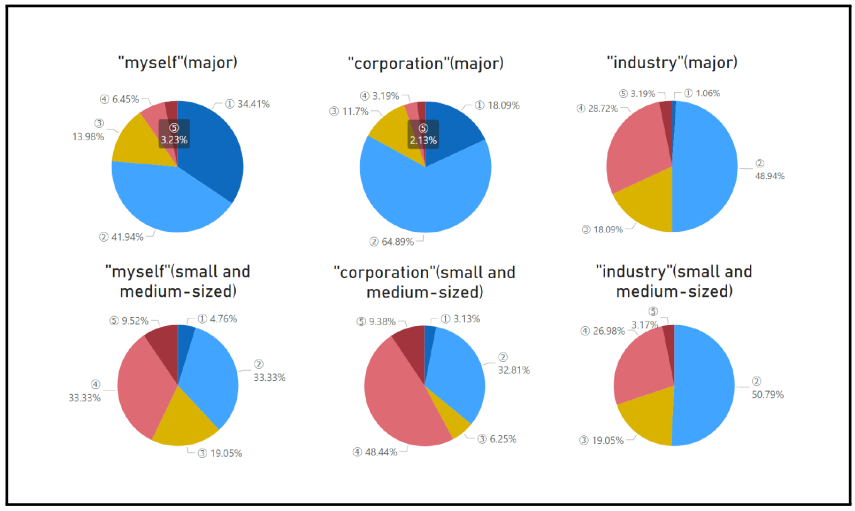
In the panel discussion, we received opinions from panelists based on this result.

Firstly, there were opinions that the penetration of "industry" was within or higher than expected, but most of the opinions were that the penetration of "myself" and "corporation" was unexpected. In particular, "(1) very permeated" was surprisingly close to 20% for "myself." there were opinions that the result was different from what was expected, because many of the participants in the conference were strong in technology. There were also multiple opinions that there may be considerable differences between major audit corporations and small and medium-sized audit corporations.

Secondary, "not permeated" ((4) and (5) in the above figure) was that "myself", "corporation", and "industry" were all around 30%. In response to this result, the panelists mentioned the need to raise the overall level.

We have verified the differences in consciousness between the participants of major audit corporations and small and medium-sized audit corporations in order to test the panelist's hypothesis that "there may be considerable differences between major audit corporations and small and medium-sized audit corporations. The results are below.

Regarding the distinction between major audit corporations and small and medium-sized audit corporations, as described on the previous page, the number of partners and employees is more than 1,000 as "major", and less than 1,000 as "small and medium".



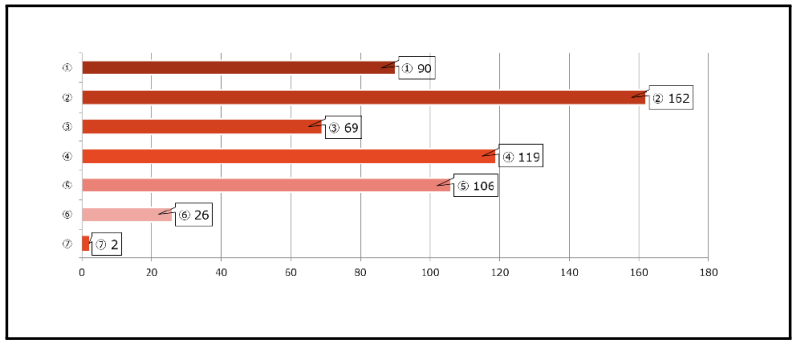
Firstly, 76% of "major" and 38% of "small and medium-sized" were "permeated" of "myself" ((1) and (2) in the above figure). This result may be suggestive that while nearly 80% of the participants, belonging to "major", practice data analysis, only about 40% of the participants, belonging to "small and medium-sized", practice data analysis. On the other hand, 10% of "major" and 43% of "small and medium-sized" of "myself" were "not penetrated" ((4) and (5) in the above figure). This result shows that there is a considerable difference between "major" and "small and medium", as the panelists expected.

Secondary, the "permeated" of "corporation" ((1) and (2) in the above figure) was 83% for "major" and 36% for "small and medium-sized". And "not permeated" of "corporation" ((4) and (5) in the above figure) was "major" 5% and "small and medium-sized" were 58%. In both cases, the difference between "major" and "small and medium-sized" is larger than that of "myself". As a result, there might be possibilities that the participants who chose "not permeated" among the "small and medium-sized" participants in "myself" felt that "the whole corporation might be permeating". Also, there might be possibilities that in "myself", those who chose "permeated" among "major" participants felt that "if it is a corporation, it might not be permeating".

Finally, the "permeated" of "industry" ((1) and (2) in the above figure) was 50% for "major" and 51% for "small and medium-sized", and "not permeated" for "industry" ((4) and (5) in the above figure) was 32% for "major" and 30% for "small and medium-sized", indicating that there is no big difference between "major" and "small and medium-sized". This result might suggest that the assumption of “major" participants have less the degree of permeating of data analysis for "small and medium”, and the assumption of “small and medium" participants have more the degree of permeating of data analysis for "major".

This result might suggest that the assumption of “major" participants have less the degree of permeating of data analysis for "small and medium”, and the assumption of “small and medium" participants have more the degree of permeating of data analysis for "major".

[Q2] What measures are effective in instilling (further) data analysis in auditing?(Multiple selections are possible)



1. Proactively send messages from regulator and the Institute of Certified Public Accountants
2. Develop an educational program
3. Make it a required subject for the qualification test
4. Make it an essential item for audit procedures
5. Create a mechanism to evaluate the auditor’s data analysis ability
6. Other
7. I don’t know

As a result, "(2) Develop an education program" was the most common, followed by "(4) Make it an essential item for audit procedures" and "(5) Create a mechanism to evaluate the data analysis ability of auditors." Various comments were received from the panelists regarding this result.

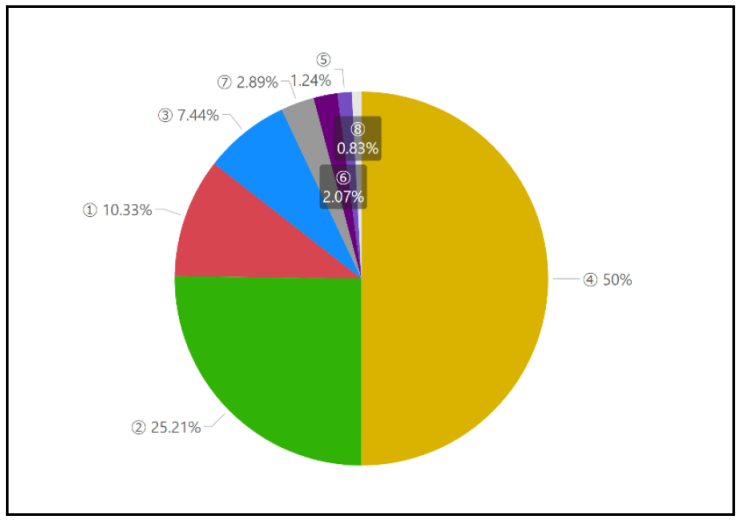
For example, according to Mr. Jason Bradley of the UK FRC, there are many "(1) Actively send messages from regulatory agencies and accountant associations" in the UK. In addition, there was a negative comment on "(4) Make it an essential item for audit procedures." The reason was that it was impossible to make it mandatory because the necessity of data analysis is decided according to the circumstances of the company. Mr. Hidehiko Yuki of the Japanese Institute of Certified Public Accountants made a similar comment on this.

According to Mr. Takashi Niidetani of KPMG AZSA LLC, the most common answer was "(2) Develop an education program", and the results were his expected. Furthermore, he mentioned that regarding the content of education, not only the education of data analysis tools but also the education of data analysis tools is important. He also commented on the importance of education on understanding information systems, which are essential for data analysis.

[Q3] Who should demonstrate leadership in promoting measures to (further) permeating data analysis in audits?

The options were:

1. Should be led by regulator
2. Should be led by each audit corporation
3. Should be led by the operating company
4. Should proceed in cooperation with regulator, audit corporations, and business companies
5. Should be led by the software company
6. Should be promoted by individual study
7. Other
8. I don't know



As a result, "(4)Should proceed in cooperation with regulatory agencies, audit corporations, and operating companies" was the most common, followed by "(2)Should be led by each audit corporation" and "(1)Should be led by regulator". Various comments were received from the panelists regarding this result.

For example, Ms. Kaori Nishiyama of the Financial Services Agency stated that each has an entity to work on and that each measure is expected to be implemented consistently, and then when designing the system, she commented that she would like to actively utilize the mechanism to incorporate the opinions of the private sector. In addition, Mr. Jason Bradley of the UK FRC commented that he would like to proceed not only with public-private partnerships but also with international collaborations.

In this session, we proceeded with the theme of "How much data analysis is being used in the audit industry !?", by listening to the comments of panelists based on the results of the participants' awareness survey. It seems that many participants were impressed by the fact that they were able to hear the actual situation and the frank opinions of each panelist.

- S17: Impact of AI audits on auditors' responsibilities (Mr. Hiroshi Taki)
  How can AI Audit affect Auditors' Responsibility? (Mr. Hiroshi Taki)

I think this session was a lecture that would guide auditors on how to approach AI Auditing. I think that the presentation, which focuses on legal liability due to misjudgment on auditing by using the technology of AI Auditing, is inferred from the guidelines on AI use in the medical field published by the Ministry of Health, Labor and Welfare, was convincing to the auditors.

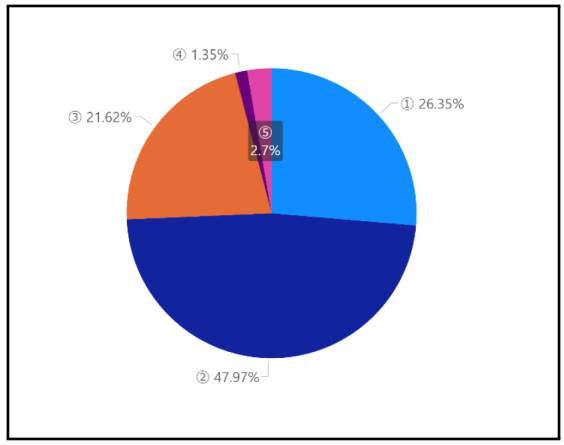
- S01: Evolutionary direction and technology that audit should aim forMr. Masahiko Tezuka
  In this session, it was emphasized that it is important not only to issue correct audit reports, but also to enhance the social effect of audits, that is, to have an awareness of improving the quality of financial products. Mr. Tezuka gave a lecture to the effect that by utilizing technology, aiming to carry out value-added audits from compliance-type audits, the accumulation will lead to reliable audits.
  Many participants seem to be impressed by the clear and easy-to-understand explanation of the ideal form of auditing that will be required of auditors from the perspective of audit quality, and the meaning of technology and human resources to realize it.
- S12 Audit Data Analytics in remote environments and the Future of Internal Auditors
  In this session, a panel discussion was held with practicing internal auditors who are studying audits using data analysis on a regular basis at a study group hosted by ICAEA JAPAN.
  We could hear the live voices of practicing internal auditors about the current state of internal audits utilizing data analysis in a remote environment, the challenges of DX conversion, and what kind of internal auditors they want to become in the future.
  We talked about the "real" of each panelist, regarding as the following issues.
  -even if they want to perform data analysis, there are high hurdles at the time of data acquisition
  -the significance of auditing by using data analysis does not easily permeate within the company
  -data analysis itself is still a special skill.
  On the above issues, they felt that challenges faced in the field such as the reality of lack of human resources and skills that can be implemented, and the solutions to them.
  There was also a concrete discussion about the future of internal auditors, such as what kind of internal auditors they feel that they need to be in the coming AI auditing era.
  It seems that the live voice of such an practicing internal auditor struck a chord with many participants and left an impression on them.

(4) Post-questionnaire: About "the degree of utilization of data analysis for business"

The answer to the question, "Are you doing business using data analysis?", was as follows.

The options are as follows.

1. Already practice data analysis as a normal business
2. Being using it, but in the process of trial and error.
3. Haven't used it, but would like to incorporate data analysis in the future.
4. Data analysis is not used and there are no plans to use it in the future.
5. Other



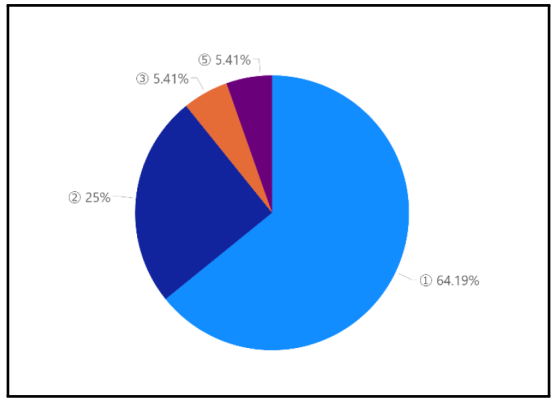
Approximately 74% of the total ((1) and (2) in the right figure) are already practicing data analysis, but nearly half of them ((2) in the right figure) are doing trial and error, and more than 20% of the total ((3) in the right figure) shows that data analysis is not currently used, but they would like to incorporate it in the future. The results show that about 96% of participants believe that data analytics should be applied to their work.

(5) Post-questionnaire: About "frequency of this conference"

The results of the frequency of this conference are as follows.

The options are as follows.

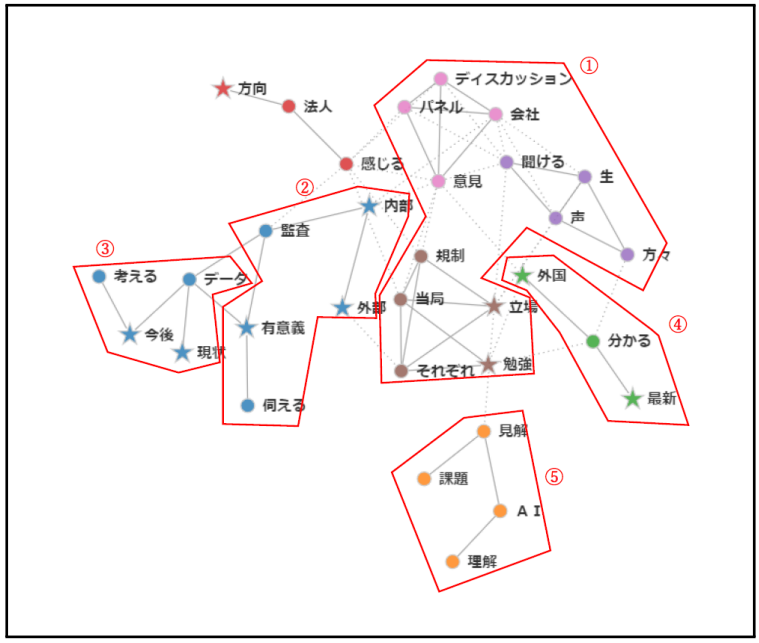
1. Every year
2. Every two years
3. Every three years
4. No need to be held
5. Other



It was found that about 95% of the people ((1) to (3) in the right figure) think that this conference should be held in the future. As you can see from the results of the questionnaire on "Points that you felt meaningful at the conference" in the next section, one of the reasons is that there are few opportunities to hear the voices of people from various positions at the same time, including overseas.

(6) Post-questionnaire: About "Points that you felt meaningful at the conference"

The following is a co-occurrence network diagram of "points that you felt meaningful at the conference".

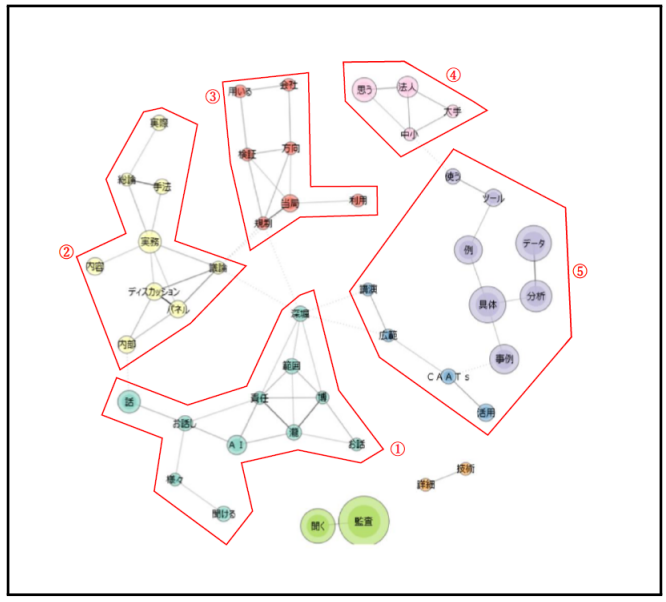


Analyzing the contents of the questionnaire based on the above co-occurrence network diagram, it seems that many participants felt that it was meaningful from the following viewpoints.

1. Could hear the live stories of people in various positions
2. Could hear the stories of both the internal auditor and the external auditor at the same time.
3. Could understand the current situation and future direction
4. Could access the latest information including overseas
5. Could understand the issues when using AI for auditing.

(7) Post-questionnaire: About "what you wanted to hear more at the conference"

The following is a co-occurrence network diagram of "what you wanted to hear more at the conference".

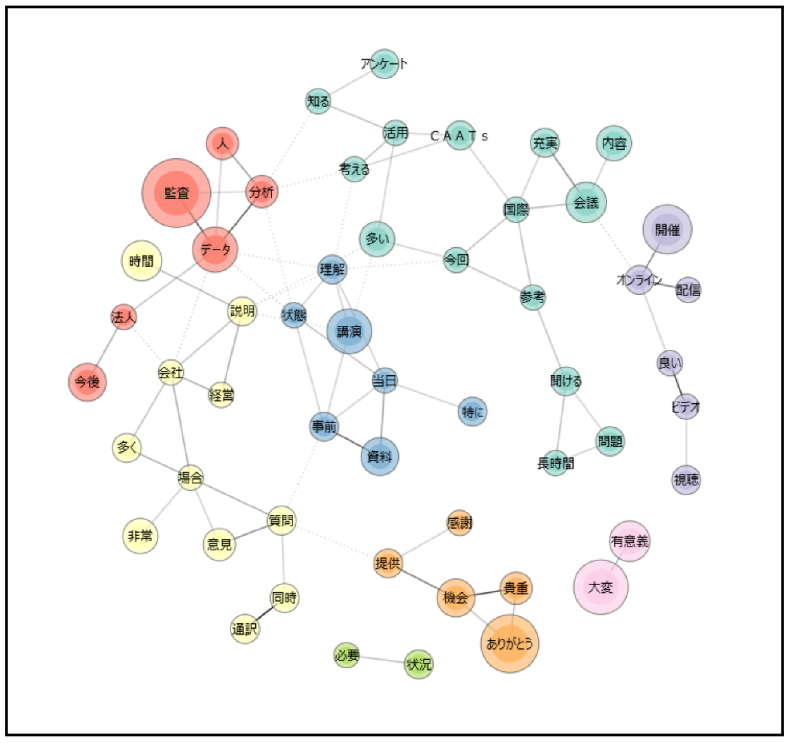


Analyzing the contents of the questionnaire based on the above co-occurrence network diagram, the following is an example of the theme that you wanted to hear in more detail.

1. AI audit and auditor responsibility
2. Discussion that deeply digs into practical issues
3. Direction of data analysis and verification within regulator
4. Efforts related to data analysis of each audit corporation
5. Cases (cases that have been made more efficient by introducing CAATs, cases of utilization other than accounting data, cases of fraud detection, etc.)

(8) Post-questionnaire: About "opinions and impressions"

The following is a co-occurrence network diagram of "opinions and impressions".



It seems that this conference was regarded as a valuable opportunity, and we received words of gratitude from many people. In addition, the simultaneous interpretation and questioning methods were well received. Regarding the content, we received the opinion that the lecturer's interesting stories did not bother us for a long time, but we also received the opinion that the day was too long. We also received suggestions that it would be better to distribute the lecture materials in advance. We would like to reflect these opinions in the next planning and plan a better event.

7 | CONCLUSION

The "2020 Computer Audit International Conference" scheduled last year has been postponed for one year because of the COVID-19, and the title has been re-held as "2021 Computer Audit International Conference in Tokyo".

The concept of this conference was "Understanding the current status, issues, and future of data analysis in auditing" -Understanding "Data analysis in auditing" from four positions-, but I decided to use this concept triggered by an email. The email was from Mr. Jason Bradley of the UK FRC who spoke at the conference, and he wrote that he was interested in the conference. At first, I was confused by an unexpected email from a British regulator, but while exchanging emails, Mr. Jason Bradley's enthusiasm was conveyed, and I was convinced that he would participate. At that time, I didn't even have acquaintances at the Financial Services Agency, which is a Japanese regulator, and I couldn't not imagine that I let alone ask an overseas regulator to give a lecture.

Anyway, I came to know that Mr. Jason Bradley could be a lecturer at the conference, then I needed to consider what

kind of theme was best with Mr. Jason Bradley as a lecturer.

First, I thought about what kind of information the world is looking for under the theme of "data analysis in auditing" rather than being feasible / impossible.

I have experienced CAATs education and CAATs introduction support for auditors of audit corporations and business companies for 25 years at an audit corporation and 4 years after retiring from an audit corporation. Although the purposes of external auditor audits and internal auditor audits are different, I felt that there were few opportunities to share information on the same conference, even though there were many things in common in terms of utilizing data analysis. Also, I came to think it would be a unique international conference if you could give a lecture to the regulators who are mainly deeply involved in external auditor audits and the research institutes that are indispensable for the development of the audit industry. Then I decided the concept of the conference above.

After the concept of the conference was decided, in order to ask the lecturer who follow the concept to give a lecture, I consulted with various people, and I was very grateful that lecturer who are active in various places accepted our offer of giving their lecture.

After the lecturer was decided, we wanted as many people as possible to listen to their lecture. Then as a result of attracting as many customers as possible, more than 400 people participated. And then, according to the post-questionnaire "opinions and impressions" was highly evaluated by many people.

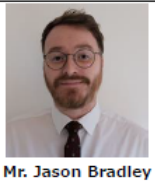
Last but certainly not least, I would like to express my sincere gratitude to the lecturer, supporting companies, and members of ICAEA for their cooperation in holding this conference.

September 2021
International Computer Auditing Education Association of Japan
Representative Director Keiji Yumiba

References

Outline of speakers and lectures

(1) Lectures

 **Mr. Masahiko Tezuka** -The Japanese Institute of Certified Public Accountants ・Chairman and President -Certified Public Accountant (CPA)	**Title : Evolutionary direction and technology that audit should aim for** As the word VUCA (*) indicates, it is very difficult to see the future of society and the economy. As future uncertainties about corporate performance increase, there is no doubt that society's needs for reliable corporate information disclosure will increase. In other words, it can be said that higher quality audits are required than ever before. In this situation, I will talk about the evolutionary direction that audit should aim for and the role that technology plays. •A word made by combining the acronyms of the four words Volatility, Uncertainty, Complexity, and Ambiguity.
 **Shi Ming (Jack) Huang Ph.D.,** -ICAEA International ・Chairman -National Chung Cheng University, Taiwan ・Professor	**Title : Computer Auditing: The way forward after COVID-19** COVID-19 has pushed organizations over the technology tipping point and transformed e-business forever. However, for CPAs or auditors, it remains challenging for the capability building in audit data analytics and machine learning. In this session, Dr. Jack Huang will discuss how important it is to learn new computer auditing for auditors, how important it is to have a good digital mindset and computer auditing competency.
 **Mr. Jason Bradley** -The UK's Financial Reporting Council (FRC) ・Project Director, Audit & Assurance Policy	**Title : Technological Resources, Using Technology to Improve Audit Quality** Technology, and its use in audit, is increasingly at the forefront of discussions between regulators, standard setters, and audit practitioners. Audit firms and third-party providers have committed significant financial and human resource to developing and deploying technology in audits, leading to a significant increase in its usage. Jason Bradley will discuss the work they have undertaken in the last 2 years to develop an understanding of how technology may be used to improve audit quality and describe their views on technology as a regulator.



Ms. Kaori Nishiyama
-FINANCIAL SERVICES AGENCY (FSA) JAPANESE GOVERNMENT
・Director for Enforcement of Corporate Disclosure, Policy and Markets Bureau

Title : Use of Technology to Improve Audit Quality

Expectations for technology are rising to improve audit quality.
I would like to share with you through this conference so that the public and private sectors can collaborate, focusing on the current situation, challenges, and expectations of Japanese regulators regarding the use of technology by auditors to perform audits.



Mr. Tetsuo Shibaya
-Grant Thornton Taiyo LLC
・Senior Partner, Head of Audit Headquarters
-Certified Public Accountant (CPA)

Title : Which direction is better for the audit industry, whether data analysis experts should be trained in auditing, or auditing experts should be trained in data analysis?

Digitization of audits is essential for maintaining and improving audit quality control. I don't think there are any experts who disagree with the opinion.
On the other hand, many leaders in the audit industry do not have the expertise to analyze data.
Most leaders agree when asked if they are willing to transform the audit work site, but when asked if they want to use data analytics by themselves, the answers might vary.
Planning decisions regarding data analysis personnel may lead to the characteristics of future audit quality at each audit firm. I will introduce our efforts in this lecture.



Tawei (David) Wang Ph.D.,
-DePaul University, USA
・Associate Professor and Driehaus Fellow School of Accountancy & MIS
-The American Accounting Association, AAA
・Midwest Region President
-Fulbright Specialist Roster: analytics curriculum for accounting programs

Title : Talents in the audit data analytics market

Audit data analytics has attracted a lot of attention in recent years. However, for audit firms, it remains challenging when recruiting talents in audit data analytics.
In this session, Mr. David Wang will discuss a research project focusing on the characteristics and flows of audit data analytics experts of the top 10 audit firms in the U.S.



Mr. Fumihiro Takahashi

-Bellsystem24 Holdings, Inc.
・Internal Audit Group
Group-Manager
-International Certified CAATs
Practitioner (ICCP)
-Systems Auditor (AU)

Title : "Comfortable control" for teleworkers Utilization for PC device log

Bellsystem24 Group is a leading company in the call center industry and is also certified by the Ministry of Internal Affairs and Communications as one of the "100 Best Telework Pioneers". For this reason, we are actively promoting initiatives such as thorough distribution of notebook PCs to employees who are managers or above, including contract employees, and teleworking the call center function itself.

On the other hand, there seems to be little information on practical cases of support and control for employees who work in the "invisible situation" of telework.

In this lecture, practicing internal auditors will talk about internal audits that should be aimed at, not just monitoring while utilizing CAATs, with their own cases.



Miss. Sherry Huang

-ICAEA Taiwan Chapter
・Chair
-Professional Development Committee, IIA Taiwan
・Chair
-Jacksoft Commerce Automation Ltd., Taiwan
・CEO

Title : A Fast Adoption Methodology of Continuous Auditing in SAP ERP Environment

Continuous Auditing is a strategic information system for an enterprise to automate control examining, risk assessment and compliance by using data analytic technology. However, for the internal audit department, it remains challenging when adopting the new technology.

In this session, Sherry Huang will discuss a fast adoption methodology of Continuous Auditing in the SAP ERP environment. It will show three industry case studies and show the life cycle of the adoption for the new technology.



Mr. Satoru Goto

-SanKei Biz Consulting, Corp.
・Operating Officer
-International Certified CAATs
Practitioner (ICCP)

Title : Current status and issues of data analysis utilization in internal audit and future prospects

The move to incorporate data analysis into internal audit is accelerating, partly due to the social trend promoting DX. The lecture will focus on points to keep in mind and tips when incorporating data analysis into internal audit.



Mr. Chu Bue-geum

-ICAEA Korea
·President
-Artner Consulting Co., Ltd.
·Chief Executive Officer
-Certified Internal Auditor (CIA)
-Certified Information Systems Auditor (CISA)

Title : Post COVID-19, Counter Strategy for Auditing Method Changing

COVID-19 Pandemic is accelerating a drastic change in audit techniques globally. Because of that, it is increased to need a change of strategic audit techniques effectively.
To use of the CAATs is rising for solving the challenge more and more. And the CAATs capability will be most important competency to overcome the issue.
Mr. Chu Bue geum who is one of the best internal audit specialists has 27 years-experience as Deloitte Risk Advisory Services Director and Member of the committee to Public Institution management assessment (Ministry of Economy and Finance, 2016) in Korea will discuss needs to enhance auditor's CAATs capabilities and data driven internal audit with his insights.



Toshifumi Takada Ph.D.,

-ICAEA JAPAN Executive Adviser
-Tohoku University
·Professor Emeritus
-National Chung Cheng University, Taiwan
·Professor

Title : Significance of Data Analytics for Auditors ~How do they control uncertainty in auditing~

Development of information technology and its use in practice has become a challenging task for auditors.
Big accounting firms have developed computer audit applications and the use of such techniques is required from clients to achieve high quality auditing.
In this keynote speech, I will pick up the topic about the methods how to decrease uncertainty (=the degree of ignorance caused on the side of auditors). My discussion is from academic. As a conclusion, I will propose the significance of using Data Analytics combined with information technology.



Ezz Hatab Ph.D.,

-ICAEA Middle East Chapter, UAE
·President
-ALDAR University College, Dubai UAE
·President

Title : Combined Assurance

Enterprises nowadays are overwhelmed with many reports that are being generated from different assurance providers including the external and internal auditors. However, still there is a chance to combine all these reports to develop a more holistic view of the enterprise risk.
Ezz Hatab will discuss the problem caused by multiple assurance providers and the solution by optimizing the coverage of assurance providers on the risk areas affecting the enterprise.
Further he will discuss an automated solution using Galvanize technology to obtain a fully integrated and data driven assurance.



Georg Herde Ph.D.,
-Business Administration and Business Informatics, Deggendorf Institute of Technology, Germany
・Professor

Title : Artificial Intelligence A solution for external auditing?

Artificial Intelligence (AI) is in a booming time and lots of resources are channeled in this direction.
There are already some tools on the growing market who apply AI in their analytics.
In my speech I'll discuss, from an academic point of view, what kind of obstacles we will have to overcome to solve some basic problems which not lonely come up by using AI in audit scenarios.
Those hurdles are, to a certain extent, well known since we use data analytics. Are those challenges obsolete just because we are using AI?



Hiroshi Taki Ph.D.,
-Ritsumeikan University, Japan
・Professor

Title : How can AI Audit affect Auditors' Responsibility ?

Looking at the transparency reports of major audit firms in recent years, it seems that they have already developed machine learning audit
tools and introduced them to audit jobs.
However, for machine learning such as deep learning, the judgment process is a black box, and not only is the basis for the judgment unclear, but it is also difficult to clarify the cause of the judgment error.
In this lecture, I would like to unravel the legal responsibilities of auditors in audits using AI from the ideal collaborative relationship between AI and humans.

Title	**The current situation, issues and outlook for the future of "Data Analytics in Audit"**
Moderator	**Mr. Keiji Yumiba** -ICAEA JAPAN Representative Director

Many people may be interested in how much data analysis is used in the audit industry, whether it is external audit or internal audit. Therefore, in this panel discussion, panelists will discuss the results while taking questionnaires from the participants. The questions are below.

- How pervasive is the data analysis method in the audit site?
- What measures are effective in instilling (further) data analysis in auditing?
- Who should demonstrate leadership in promoting measures to (further) permeating data analysis in audits?

Panelists



Mr. Jason Bradley
-The UK's Financial Reporting Council (FRC)・Project Director, Audit & Assurance Policy



Ms. Kaori Nishiyama
-FINANCIAL SERVICES AGENCY(FSA) JAPANESE GOVERNMENT
・Director for Enforcement of Corporate Disclosure, Policy and Markets Bureau



Mr.Hidehiko Yuki
-The Japanese Institute of Certified Public Accountants
・Managing Director of IT
-Certified Public Accountant (CPA)



Mr. Tetsuo Shibaya
-Grant Thornton Taiyo LLC
・Senior Partner, Head of Audit Headquarters
-Certified Public Accountant (CPA)



Mr. Takashi Niidetani
-KPMG AZSA LLC
・ Digital Innovation Division Partner
-Certified Public Accountant (CPA)

Title	Audit Data Analytics in remote environments and the Future of Internal Auditors
Moderator	**Mr. Tetsushi Ueno** -ICAEA JAPAN Managing Director

Due to the spread of remote work and restrictions on site visits, internal audits are also required to be transformed by utilizing technology by promoting DX, and it can be said that the introduction of audits by using data is no longer inevitable.
Therefore, in this panel discussion, leading-edge practicing internal auditors will read "Data analysis in audits" with the following themes.

- What is the current state of auditing by using data in a remote environment?
- What are the challenges facing the internal audit department to respond to digital transformation?
- What is the future of internal auditors in the age of AI?

Panelists



Mr. Fumihiro Takahashi
-Bellsystem24 Holdings, Inc.
・Internal Audit Group Group-Manager
-International Certified CAATs Practitioner (ICCP)
-Systems Auditor (AU)



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