

Results of research into the impact on certified public accountant services of advances in technologies such as AI

Overview of research project

Operations covered

- Restricted to audit services (consulting, taxation services, etc. were excluded)

Research goals

- (1) To identify the domains in audit services with the most potentiality of substitution for technologies such as AI,
- (2) To show domains from (1) above with relatively low importance, and
- To identify that productivity of audit services would improve if working time is shifted from the domain with higher potentiality of the substitution by AI and other technology to the one with lower potentiality

Research methodology

- Perform a survey to certified public accountants (CPAs) through the questionnaire set up on website.

Scope of research

- CPAs in four accounting firms(2 large, 2 smaller) for audit services.
- Approximately 400 participants in the survey.
- CPAs acting as engagement partners, audit managers, and audit assistants

Basic information

- Surveying period: September 2019 to March 2020
- Respondents: 395 (response rate: approximately 86%), consisting of 101 engagement partners, 99 audit managers, and 195 audit assistants

Establishing the hypothesis

We formed a hypothesis in relation to the potential for substitution by AI for each of the following occupational classes in accounting firms such as engagement partner, audit manager, and audit assistants.

| Position | Hypothesis | Method used to verify |
|--------------------|--|---|
| engagement partner | The bulk of the work is likely to be made up of procedures that could not be substituted by AI , such as communication with management. | For engagement partners the hypothesis was self-evident, and therefore no special research topics were set . |
| Audit manager | The bulk of the work is likely to be made up of operations that would be difficult to substitute by AI , such as communicating with clients, designing appropriate audit procedures, and providing guidance and instruction to audit assistants. | <ul style="list-style-type: none"> Implemented questions relating to how much time was spent on each procedure by the audit manager personally during the period of the audit operation as a whole. Implemented questions for the engagement partner relating to which elements of the work they would attach importance in a scenario where they are considering which one of multiple audit managers to promote. |
| Audit assistant | <ul style="list-style-type: none"> While some procedures for confirmation and testing of documents could be substituted by AI, it is likely that there are operations where the individual could not be substituted by AI, such as asking the client questions. Accordingly, it is likely that, by utilizing AI in operations where substitution is possible and focusing on operations where the potential for substitution is low, overall productivity would be improved. | <ul style="list-style-type: none"> Implemented questions relating to how much time was spent on each procedure by the audit assistant personally during the period of the audit operation as a whole. Implemented questions for the audit manager relating to which elements of the work they would attach importance in a scenario where they are considering which one of multiple audit assistants to promote. |

Identify the domains in audit manager activities

10 domains were selected from among operations performed by audit managers and audit assistants, and were evaluated by the RIKEN Center for Advanced Intelligence Project (AIP Center) for the potential for substitution by AI. For this evaluation, JICPA provided AIP Center of the detailed information of the activities in the 10 domains.

<Details of audit manager operations>

| Domain | Example details of operations |
|--|--|
| (1) Coordination with client | <ul style="list-style-type: none"> Various types of communication with the client, such as negotiations, discussions, and reports (including audit fee negotiations and responses to individual projects) |
| (2) Audit team management | <ul style="list-style-type: none"> Instructions to audit team members, schedule management, etc. |
| (3) Risk assessment when entering into audit engagements (when concluding new agreements or renewing) | <ul style="list-style-type: none"> Implementing risk assessments and performing procedures for acceptance of work within the audit firm |
| (4) Understanding of the entity's environment and assessment audit risk | <ul style="list-style-type: none"> Updating the understanding of the entity required to design the audit plan, and conducting audit risk assessments |
| (5) Design and, where necessary, revision of appropriate audit procedures | <ul style="list-style-type: none"> Design of audit procedures at the audit planning stage Considering and designing additional audit procedures to be used in response to the occurrence/discovery of events not predicted at the time of the initial plan |
| (6) Carrying out typical audit procedures | <ul style="list-style-type: none"> Implementing routine audit procedures such as analytical procedures, testing of documents, and testing of accounts (including audits of internal control/quarterly review procedures) |
| (7) Carrying out atypical procedures, or implementation of additional procedures in cases where the results of those performed in (6) were insufficient to form an opinion | <ul style="list-style-type: none"> Audit of accounting estimates Judgments, etc. on the appropriateness of accounting treatments related to irregular transactions |
| (8) Investigation and making judgements on material audit matters (responding to irregularities, etc.) | <ul style="list-style-type: none"> Responding to and assessing material audit matters (matters on which the audit client seeks advice; occurrences of material new events, such as M&A; occurrences of fraud) |
| (9) Reviewing audit documentation and forming audit opinion | <ul style="list-style-type: none"> Assessing the results of audit procedures implemented, and summarizing the audit opinion Performing concurring review and other procedures for audit quality |
| (10) Writing management letter (Summarizing the findings and recommendations for the audit client) | <ul style="list-style-type: none"> Writing management letter for the audit client, summarizing findings and recommendations noted during the audit |

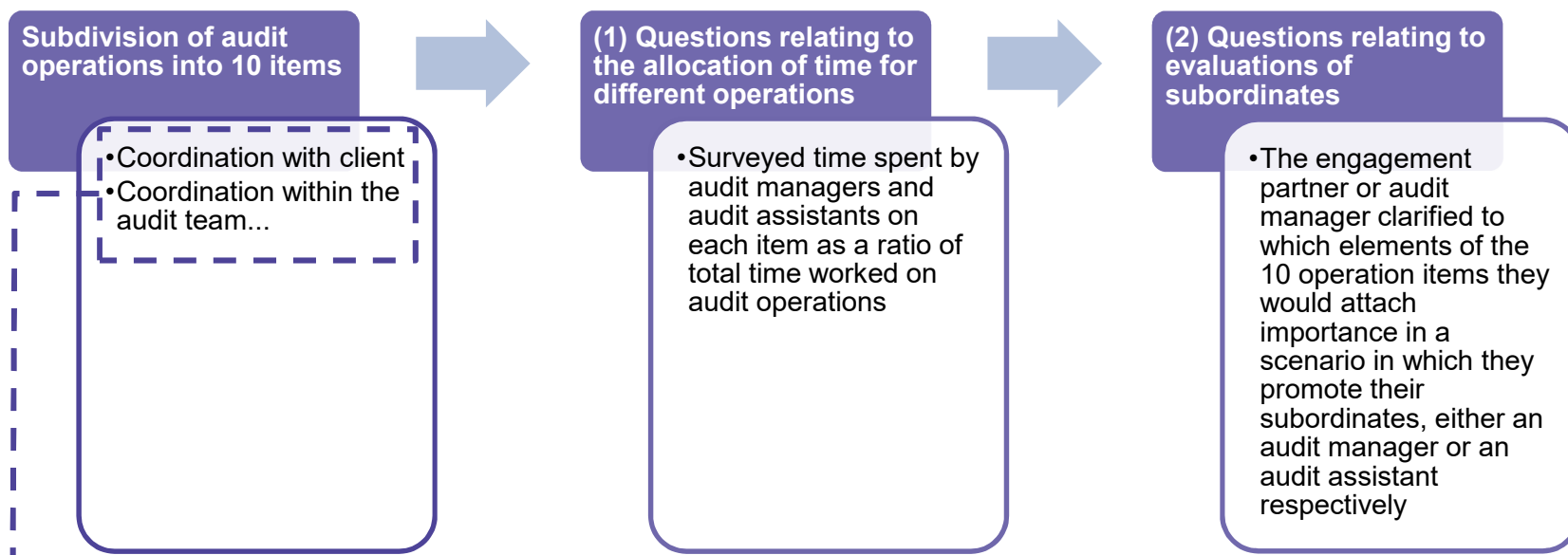
Identify the domains in audit assistant operations

<Details of audit assistant operations>

| Item | Example details of operations |
|---|--|
| (1) Coordination within the audit team | <ul style="list-style-type: none"> • The coordination of various tasks, such as allocation of work, thus enabling on-site audit operations to proceed smoothly |
| (2) Coordination with client | <ul style="list-style-type: none"> • Various types of communication with the client, such as negotiations, discussions, and reports |
| (3) Overall assessments of entity controls | <ul style="list-style-type: none"> • Understanding and assessing the internal control in overall, including the implementation of IT |
| (4) Understanding business processes | <ul style="list-style-type: none"> • Understand the regulation, applicable financial reporting framework and accounting policies. In addition, understand the nature of the entity, including its operations, its ownership governance structures, and financing structures, to understand the classes of transactions, account balances, and disclosures to be expected in the financial statements |
| (5) Test of the effectiveness of controls | <ul style="list-style-type: none"> • Performing test of the effectiveness of the controls built in the business cycle |
| (6) Inspection, confirmation, observation (attendance) | <ul style="list-style-type: none"> • For example, the auditors themselves observe physical inventory taking performed by the audit client to gather audit evidence on the existence of the assets recorded in the financial statements |
| (7) Testing of documents, testing of accounts, and analytical procedures | <ul style="list-style-type: none"> • Testing documents and accounts is to obtain breakdown of the amounts in the financial statements to trace the amounts to those in the related books or other documentation, a part of which is originated externally • Analytical procedures is to evaluate financial information through analysis of plausible relationships among both financial and non-financial data |
| (8) journal entry test | <ul style="list-style-type: none"> • Test the appropriateness of journal entries recorded in the general ledger and other adjustments made in the preparation of the financial statements |
| (9) Additional procedures to be performed in cases where the results in (6), (7), or (8) were insufficient to form an audit opinion | <ul style="list-style-type: none"> • Design and perform the audit procedures to gather additional audit evidence, depending on the specific circumstances |
| (10) Test of the presentation of the annual and quarterly financial statements | <ul style="list-style-type: none"> • Test whether the assets, liabilities and equity interests in the financial statements appropriately aggregated or disaggregated and clearly described, and related disclosures are relevant and understandable in the context of the requirements of the applicable financial reporting are framework |

Questions

- Provide audit managers and audit assistants with the survey questions relating to roughly what percentage of the total time spent working on audit operations is allocated to operations listed in the 10 domains just identified
- Provide the engagement partner with the survey questions, who is senior to the audit manager and audit assistants, about what weightings they assign to the duties listed in the 10 domains during the process of personnel appraisal. To analyze the result of survey questions, conjoint measurement methods which are utilized in a range of fields such as policy assessment, the environmental economics, and marketing.

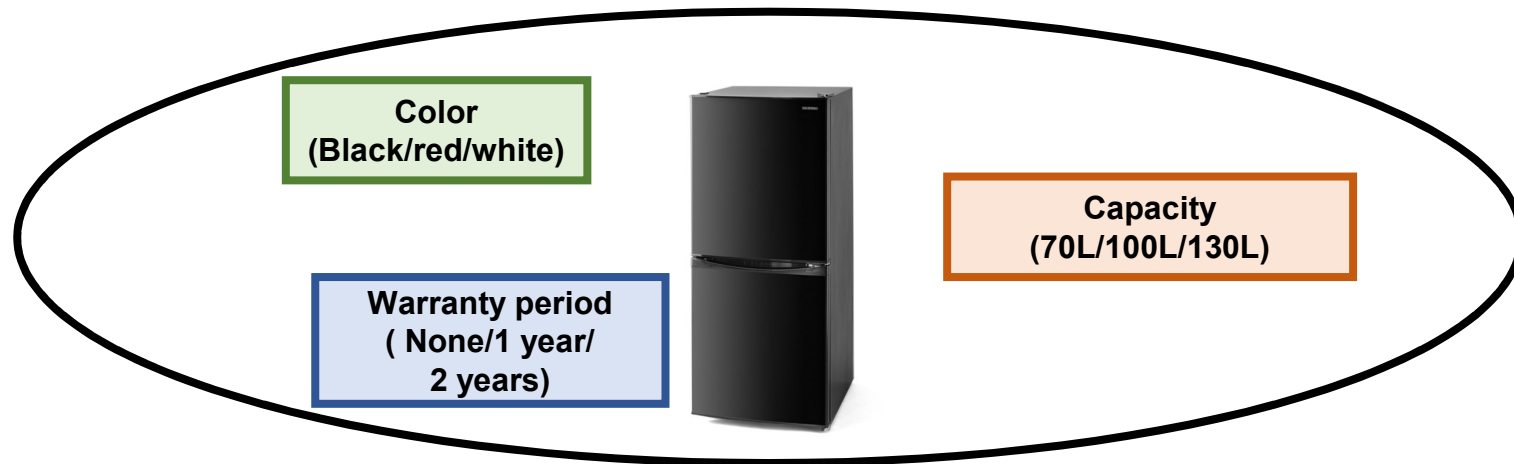


The potential for substitution for each item was assessed by the RIKEN AIP Center

Conjoint analysis

What is conjoint analysis?

- An analytical technique used to understand the composition of consumer preferences towards products and services, which is often used in marketing
- Example of use in marketing (refrigerator):
A technique in which overall preference (**overall utility**) is decomposed into preferences for each attribute (**part worth utility**), and used to distinguish which **attributes** (e.g. color, warranty period, capacity) are awarded importance



Conjoint analysis

- On this occasion the activities performed by the audit managers and audit assistants are classified into 10 domains, and assessed for importance from the perspective of which domains (attributes) are preferred
- The hypothesis is that overall utility (**personnel appraisal of the activities by one certified public accountant**) is composed of part worth utilities (**the total of the 10 domains of the activities**)

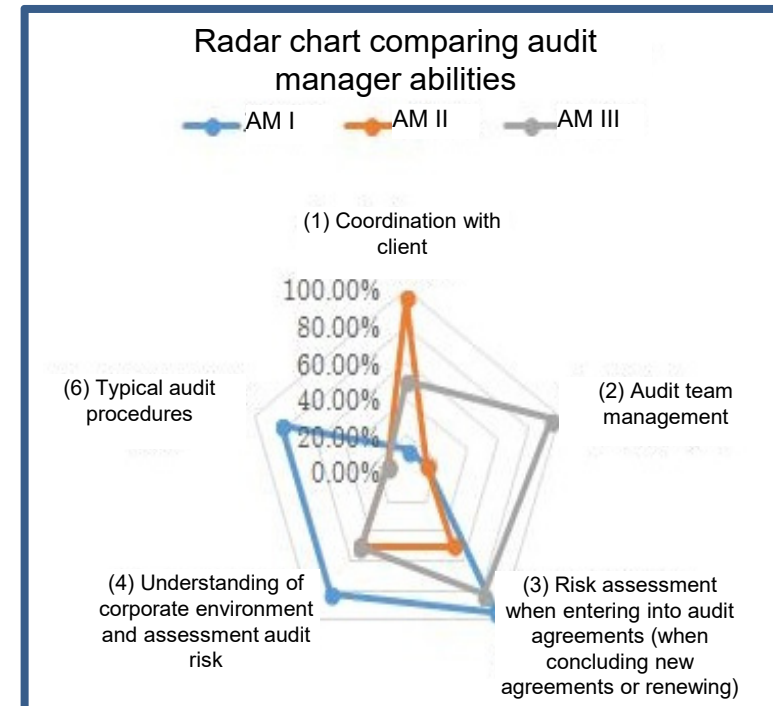
$$\text{Overall utility } U = (1) \text{ Coordination with client } \times \beta_1 + (2) \text{ Audit team management } \times \beta_2 \\ + \dots + (10) \text{ Creation of management letter, etc.} \times \beta_{10} + \text{error}$$

Part worth utilities

Conjoint analysis

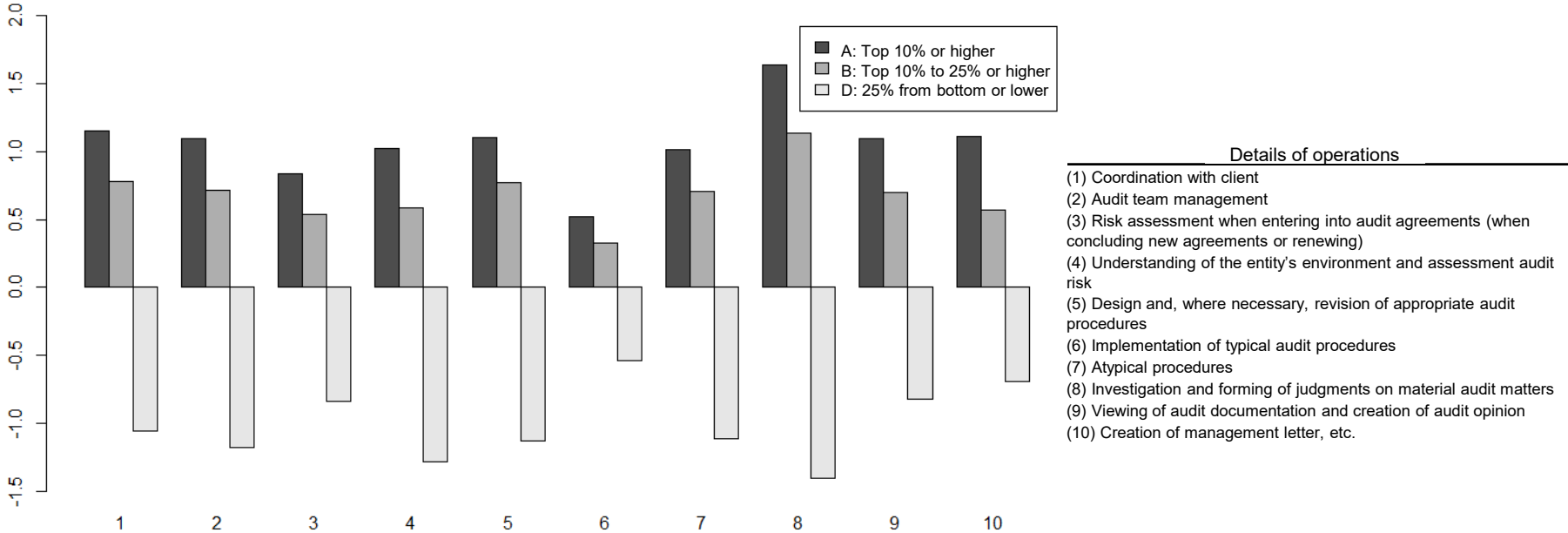
Method used to infer specific part worth utilities

- (1) Randomly select 5 of the 10 attributes
- (2) For the 5 attributes, representations of 3 CPAs (AM [Audit Manager] I, AM II, AM III, etc.) are shown, as in the chart on the right, whose level in operations is
 - A: Top 10%
 - B: Top 10% to 25% or so
 - C: Top 25% to bottom 25% or so
 - D: Bottom 25%
- (3) Of these three, the individual **who most deserves promotion** is selected
- (4) Each respondent to the survey is asked 20 questions, in which they are shown **5 randomly selected attributes and evaluations**
- (5) The engagement partner or audit manager is asked questions presenting a scenario in which they promote their subordinates, either an audit manager or an audit assistant respectively



Results of assessments using conjoint analysis (audit manager)

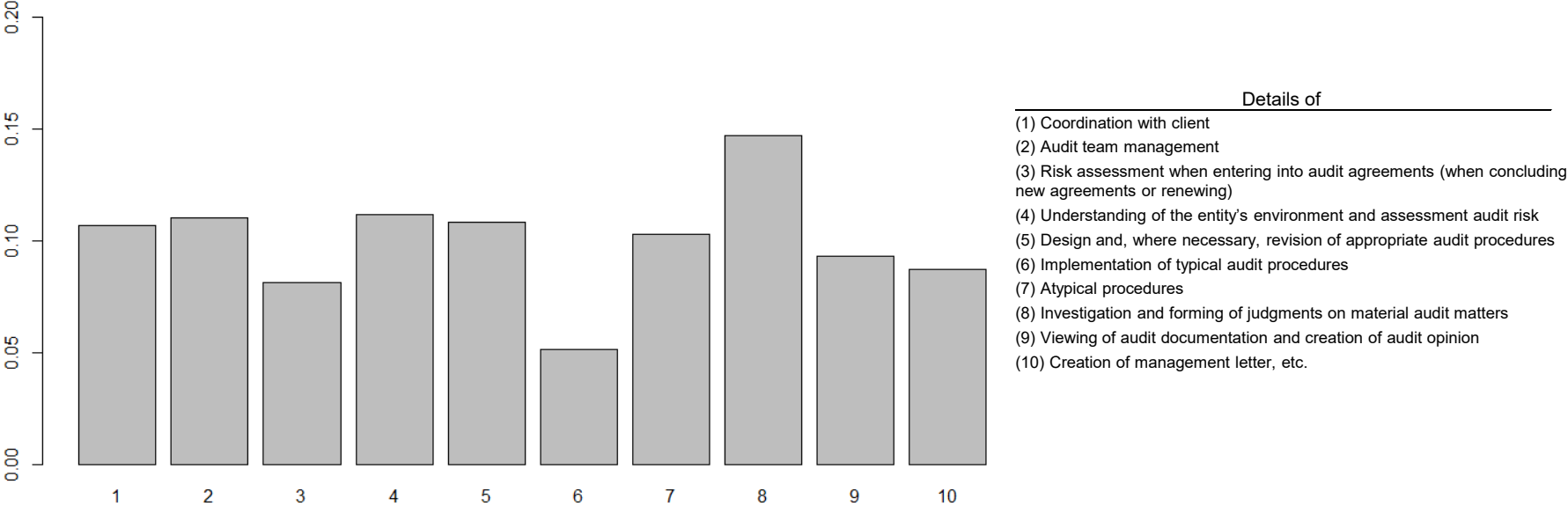
- The impact on personnel appraisal of each audit manager operation using conjoint analysis follows;



- Assessment level C (From Top25 to Top75%) is regarded as with in the normal range, and thus, is disregarded in this diagram.

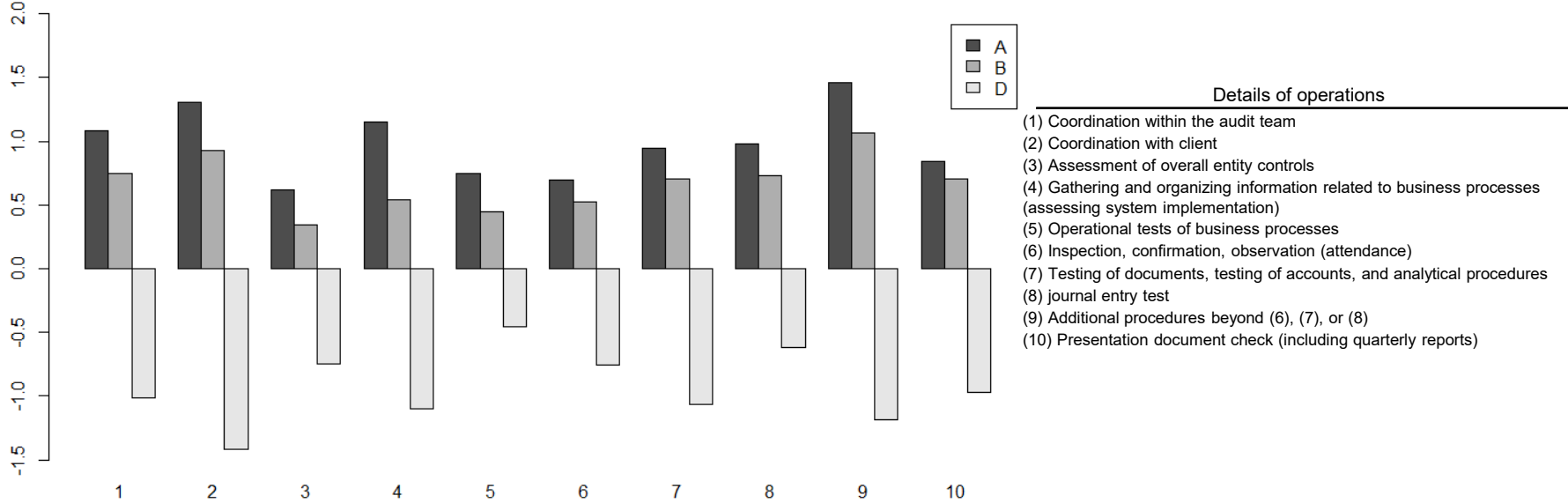
Results of assessments using conjoint analysis (audit manager)

- The importance (on a scale of 0 to 100%) for promotion of a personnel appraisal of each audit manager activity using conjoint analysis follows;



Results of assessments using conjoint analysis (audit assistant)

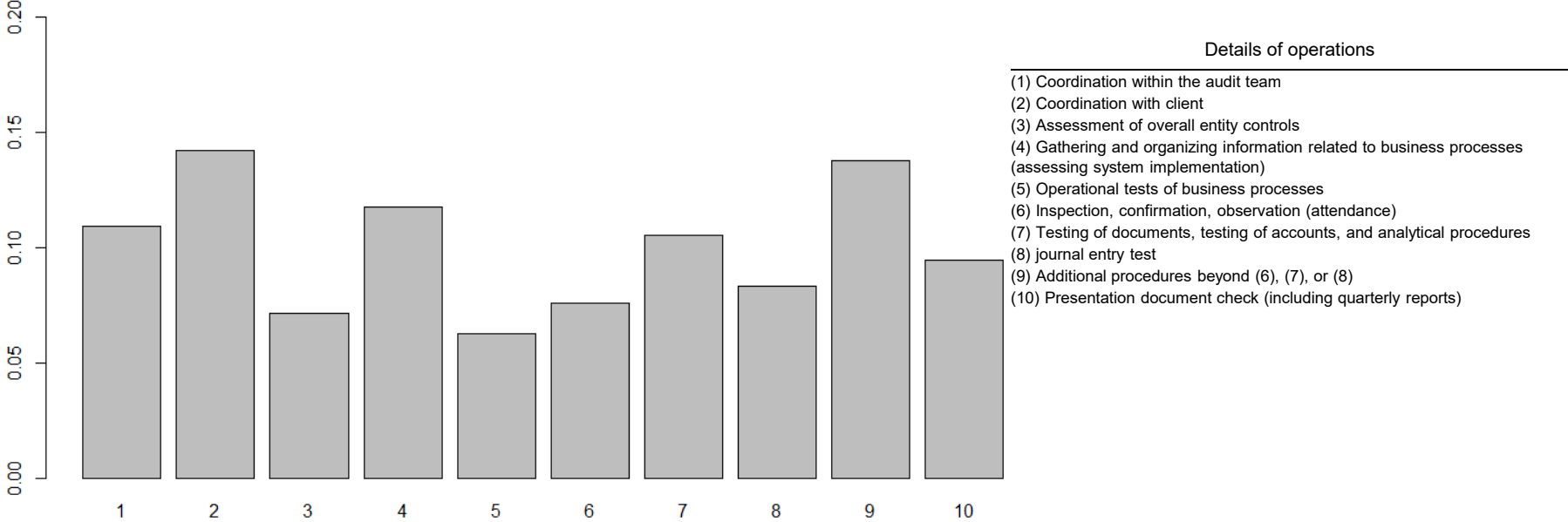
- The impact on personnel appraisal of each audit assistant operation using conjoint analysis was as follows



- Assessment level C is the benchmark (average: from top 25% to 25% from bottom)

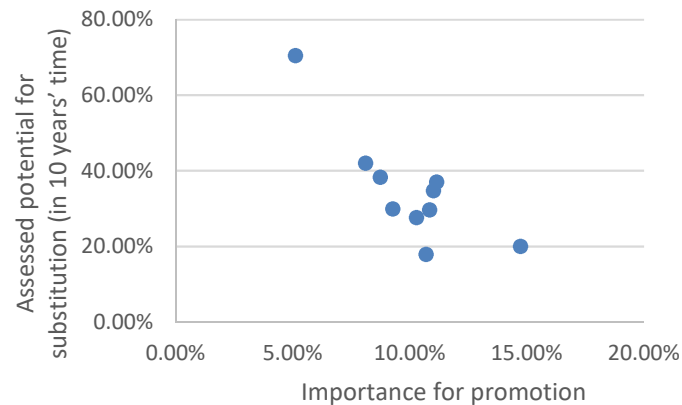
Results of assessments using conjoint analysis (audit assistant)

- The importance (on a scale of 0 to 100%) for promotion of an assessment of each audit assistant operation using conjoint analysis was as follows



Relationship between assessment of potential for substitution and importance for personnel evaluation (audit manager)

- The importance (on a scale of 0 to 100%) for promotion of an assessment of each audit manager operation using conjoint analysis was as follows



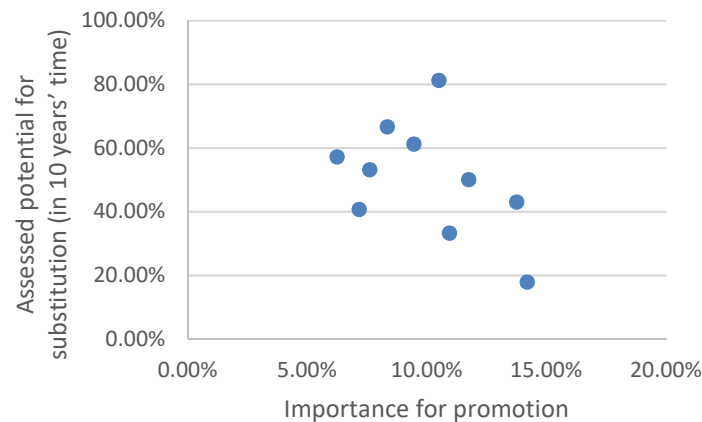
| Audit manager (n=101) | | |
|--|---|--------------------------|
| Details of operations | Potential for substitution (in 10 year range) | Importance for promotion |
| (1) Coordination with client | 17.87% | 10.70% |
| (2) Audit team management | 34.67% | 11.02% |
| (3) Risk assessment when entering into audit agreements (when concluding new agreements or renewing) | 41.99% | 8.12% |
| (4) Understanding of the entity's environment and assessment audit risk | 36.99% | 11.16% |
| (5) Design and, where necessary, revision of appropriate audit procedures | 29.62% | 10.84% |
| (6) Implementation of typical audit procedures | 70.44% | 5.12% |
| (7) Atypical procedures | 27.62% | 10.29% |
| (8) Investigation and forming of judgments on material audit matters | 19.96% | 14.73% |
| (9) Viewing of audit documentation and creation of audit opinion | 29.91% | 9.28% |
| (10) Creation of management letter, etc. | 38.25% | 8.74% |

Main results of analysis

- With regard to the items evaluated for audit managers, it was found that **operations with a low potential for substitution were considered important in terms of personnel reviews**

Relationship between assessment of potential for substitution and importance for personnel evaluation (audit assistant)

- The importance (on a scale of 0 to 100%) for promotion of an assessment of each audit manager operation using conjoint analysis was as follows



| Audit assistant (n=99) | | |
|--|---|--------------------------|
| Details of operations | Potential for substitution (in 10 year range) | Importance for promotion |
| (1) Coordination within the audit team | 33.26% | 10.95% |
| (2) Coordination with client | 17.87% | 14.20% |
| (3) Assessment of overall entity controls | 40.74% | 7.17% |
| (4) Gathering and organizing information related to business processes (assessing system implementation) | 50.02% | 11.75% |
| (5) Operational tests of business processes | 57.21% | 6.25% |
| (6) Inspection, confirmation, observation (attendance) | 53.18% | 7.61% |
| (7) Testing of documents, testing of accounts, and analytical procedures | 81.19% | 10.51% |
| (8) journal entry test | 66.66% | 8.35% |
| (9) Additional procedures beyond (6), (7), or (8) | 43.00% | 13.76% |
| (10) Presentation document check (including quarterly reports) | 61.26% | 9.46% |

Main results of analysis

- For audit assistants, the most important item in personnel appraisal is “Coordination with client,” which has the lowest potential for substitution
- However, the item assessed to have the highest potential for substitution, “(7) Testing of documents, etc.,” also has a certain level of importance in personnel evaluations

Productivity analysis (audit manager)

- Assuming that some audit operations are substituted by AI, the expected audit time per person per year in 10 year range is as follows

| Details of operations | Potential for substitution (in 10 year range) | Audit time per person per year(h) | Expected audit time per person per year in 10 year range (h) |
|--|---|-----------------------------------|--|
| (1) Coordination with client | 17.9% | 127.68 | 104.87 |
| (2) Audit team management | 34.7% | 124.17 | 81.12 |
| (3) Risk assessment when entering into audit agreements (when concluding new agreements or renewing) | 42.0% | 49.33 | 28.62 |
| (4) Understanding of the entity's environment and assessment audit risk | 37.0% | 114.71 | 72.28 |
| (5) Design and, where necessary, revision of appropriate audit procedures | 29.6% | 109.35 | 76.96 |
| (6) Implementation of typical audit procedures | 70.4% | 116.91 | 34.56 |
| (7) Atypical procedures | 27.6% | 98.57 | 71.35 |
| (8) Investigation and forming of judgments on material audit matters | 20.0% | 122.24 | 97.84 |
| (9) Viewing of audit documentation and creation of audit opinion | 29.9% | 118.22 | 82.86 |
| (10) Creation of management letter, etc. | 38.3% | 62.00 | 38.28 |
| | | | |

- As a result of combining the data above with the information on the importance of each operation obtained from the questions on personnel evaluation, the predicted potential for improvements in productivity for audit manager operations was 32.0% and 42.5% in 10 years' time and 30 years' time respectively.

Productivity analysis (audit assistant)

- Assuming that some audit operations are substituted by AI, the expected audit time per person per year in 10 year range is as follows

| Details of operations | Potential for substitution (in 10 year range) | Audit time per person per year(h) | Expected audit time per person per year in 10 year range(h) |
|--|---|-----------------------------------|---|
| (1) Coordination within the audit team | 33.3% | 151.79 | 101.31 |
| (2) Coordination with client | 17.9% | 140.60 | 115.48 |
| (3) Assessment of overall entity controls | 40.7% | 64.68 | 38.33 |
| (4) Gathering and organizing information related to business processes (assessing system implementation) | 50.0% | 132.75 | 66.35 |
| (5) Operational tests of business processes | 57.2% | 131.04 | 56.07 |
| (6) Inspection, confirmation, observation (attendance) | 53.2% | 114.54 | 53.63 |
| (7) Testing of documents, testing of accounts, and analytical procedures | 81.2% | 370.36 | 69.65 |
| (8) journal entry test | 66.7% | 83.94 | 27.99 |
| (9) Additional procedures beyond (6), (7), or (8) | 43.0% | 89.20 | 50.84 |
| (10) Presentation document check (including quarterly reports) | 61.3% | 156.33 | 60.56 |

- As a result of combining the data above with the information on the importance of each operation obtained from the questions on personnel evaluation, the predicted potential for improvements in productivity for audit assistant operations was 48.4% and 58.0% in 10 years' time and 30 years' time respectively.