Theme I Discussion Paper

Information Technology
for the Development of Public Administration

1. Introduction

In recent years, information technology has significantly influenced most aspects of human society. In particular, the information technology revolution represented by mobile internet, cloud computing, big data, and artificial intelligence is on the rise. In this process, new technological innovations have produced exponential growth of data in a variety of forms, providing the basis for more rational and efficient public decision-making. Meanwhile, social media and mobile internet have made decision-making more accessible to the public, thereby increasing transparency, supervision, and accountability in national governance.

From the perspective of the development of the audit function, supreme audit institutions (SAIs) worldwide have undertaken increasingly important duties in strengthening accountability, promoting good governance, and monitoring the implementation of sustainable development goals in their respective countries. The XXII Congress of the International Organization of Supreme Audit Institutions (INCOSAI) in 2016 adopted "How can INTOSAI contribute to the UN 2030 Agenda for Sustainable Development, including good governance and strengthening the fight against corruption?" as the topic for Theme I. In its *Strategic Plan 2017-2022*, INTOSAI mapped out a clear vision to "promote good governance by enabling SAIs to help their respective governments improve performance, enhance transparency, ensure accountability, maintain credibility, fight corruption, promote public trust, and foster the efficient and effective receipt and use of public resources for the benefit of their citizens." In the era of big data, SAIs are aware of the importance of information technology to improve audit quality so as to help their respective countries implement their sustainable development strategies.

Based on such understanding, in November 2017, the 70th Meeting of the INTOSAI Governing Board endorsed "Information Technology for the Development of Public Administration" as Theme I of the XXIII INCOSAI, which was proposed by the Accounts Chamber of the Russian Federation. The Theme is chaired by the National Audit Office of China (CNAO), and the Office of the Auditor General of Canada is the vice chair. According to the rules of procedure proposed to the XXIII INCOSAI, CNAO developed the principal paper, conducted the survey, analyzed the results of the questionnaires from 64 members of INTOSAI, and drafted the discussion paper.

This paper covers five subjects: (1) the role of information technology in public administration; (2) data applications for the improvement of public administration; (3) characteristics of big data audit; (4) the role of big data analytics in the fulfillment of SAIs' duties; and (5) the challenges faced by big data audit and coping strategies of SAIs.

2. Definitions

There are various definitions for "public administration," both from academia and from policy makers. In order to direct the discussion to the main topic regarding public administration and government auditing, we define public administration as the behaviour of the government-centred public sector, which integrates various social forces to strengthen the government's governance capabilities, enhance its performance, and improve the quality of public services. Public administration is carried out in the public interest, with government departments and public organizations that take on public accountability as its subject; public assets, public resources, public projects, and social issues as its object; and the pursuit of fairness and efficiency as its management goal.

It is widely acknowledged that big data is characterized by five Vs: volume, variety, velocity, veracity, and value. Though big data analytics has been used in auditing, there is no consensus on the definition for "big data audit." In the context of public administration and government auditing, big data audit refers to SAIs' actions including collecting multi-source data from the audited entities or the public; carrying out cross-domain and intelligent data analysis; improving the quality and efficiency of auditing; and making better use of auditing in improving performance, transparency, credibility, and accountability of the government. The ultimate purpose of big data audit is to promote good governance and the sustainable development of society.

3. Subjects for Discussion

3.1 The Role of Information Technology in Public Administration

The use of information technology in public administration has evolved for decades. At the early stage, office automation promoted the digitization of business processes. With the establishment of public administration IT systems, data processing capabilities and efficiency of public administration were enhanced. In recent years, the internet has been introduced to extend public administration IT systems beyond the government in terms of technology and functionality.. It is believed that data utilization is aimed to improve the quality of public administration, and public services can play important roles in the following aspects:

3.1.1 More transparent public administration through data disclosure

First of all, we believe that it is important to ensure the security and reliability in the use of information and telecommunications technologies, and to ensure the rights and interests of

individuals and corporations without compromising national security.. Based on these principles, promoting openness of data resources in public institutions will help strengthen the supervision of public administration practices, increase transparency, ensure standards, and enhance integrity. As a result, the public can fully exercise their right to know, and the credibility of public administration will be enhanced.

3.1.2 More effective departmental coordination through data sharing

Data sharing in different fields and institutions, along with professional data analysis methods, can more effectively promote the administrative capacity of the public sector. Based on a rational top-level design and overall planning, it is necessary to clearly define the scope and use of data-sharing in public institutions, to clarify duties and rights in data management for sharing among various departments, and to establish a platform for data sharing at regional, departmental, and governmental levels. The building of an interconnected, collaborative system with enhanced application can help improve the convenience and efficiency of cooperation among public institutions.

3.1.3 Better decision-making through data analysis

Authentic and reliable data can not only record the implementation process of the public sector, but also provide the essential basis for public decision-making. Public institutions collect, integrate, analyze, and utilize large volumes of decentralized data from public institutions, industries, and society to support their decision-making. By doing so, they can take various needs of social development into full consideration, improve public administration methods, and strengthen rational decision-making.

3.1.4 Better targeted public services through data integration

By collecting, integrating, and analyzing data, public institutions can promptly understand the real needs and concerns of the public, then take actions or deliver targeted services. They will be able to take into full account the public opinions, effectively respond to public appeals, and improve the quality of public administration and citizen satisfaction.

The practices in different countries shared by almost 60 SAIs shows that most departments in their countries have information systems to assist them in their daily work, and some departments use social media to reach their clients while some use IT systems in providing public service in their countries. The practices also show that most areas of interaction with citizens are facilitated by use of data, such as tax collection, social insurance, government budget, finance, and physical resource management. In the practices of their countries, data is a core resource of public administration. It informs decision-making about public policy and public management, supports the provision of services to the public, and constitutes a service in itself. It provides a record of government activity for current and future use, and by extension the basis for accountability.

3.2 Data Application for the Improvement of Public Administration

Data is a fundamental strategic resource for improving the economy, efficiency and effectiveness of all government operations and can be used to plan, measure, monitor, and assess operations of a very broad scope. By analyzing the data capacity of different countries, we have categorized the measures of strengthening data utilization and improving public administration in three aspects: strategic planning, capability development, and implementation measures.

3.2.1 Strategic planning.

Governments should promote overall planning of national-level data strategies, clear goals, key application fields, management systems, and international cooperation mechanisms. Data strategy at the policy level will be a key factor, supported by infrastructure, which will facilitate effective information exchange and capacity development.

3.2.2 Capability development.

Governments should

- improve infrastructure,
- collaborate with universities and research institutes to develop new technologies,
- increase investment and set up supporting funds, and
- attract and create incentives for technological innovations talents.

3.2.3 Implementation measures.

Governments should

- establish or designate an agency to promote big data application;
- introduce policies for data disclosure, integration, and sharing;
- develop a data risk assessment mechanism to identify the boundaries for data sharing and openness, and set up a unified platform for open data;
- emphasis on data security and privacy protection;
- facilitate the effective use of publicly funded research findings and data; and
- develop a data utilization model based on collaboration among public institutions, the private sector, civil society organizations, and citizens.

Currently, public institutions still face numerous problems in data disclosure, sharing, integration, analysis, application, and security. In the process of fulfilling their duties, audit institutions can provide recommendations on data quality and data sharing. In addition, auditors can conduct performance audits of data application in the public sector, by assessing the effectiveness and risks.

3.3 Characteristics of Big Data Audit

In the era of big data, data has been recognized as one of the most valuable strategic resources for

countries. Governments are implementing the strategies of data management at the national level, enforcing the data sharing and attempting to enhance the quality of public administration by using big data. For SAIs, conducting big data audit has become a necessity in response to the era of big data. In December 2015, when the INTOSAI Knowledge Sharing Committee (KSC) conducted a survey among its members on research topics, 21 countries put forward 60 research projects. The topic of big data received the most attention and was also the theme of a number of seminars held by various INTOSAI members and regional organizations. The INTOSAI Working Group on Big Data (WGBD) was formally established in December 2016, marking a milestone in the development of big data audit of SAIs. At its first meeting in Nanjing in April 2017, 49 participants from 18 SAIs shared their experience and understanding concerning opportunities and challenges in this respect.

It is believed that big data in audit includes structured, semi-structured, and unstructured data, the basic features of which are massive quantity and diversity. However, big data audit is not just a matter of gathering mass data and using advanced techniques. It is a brand new embodiment of audit work under new circumstances, and it is closely related to the duties of SAI.. Based on the case studies collected from various SAIs, we have summarized the characteristics of big data audit as five Ms: multi-source, multi-perspective, multi-relationship, multi-technique, and multi-mode.

3.3.1 Multi-source.

Big data audit is different from the collection of a single type of data, since it requires the extensive collection of financial data, operating data, and management data from many audited entities, as well as open data on the internet, rather than data from a few sources. Inasmuch as big data analytics involves more fields with a broader range, it is the combination of all types of data.

3.3.2 Multi-perspective.

Big data audit provides a wealth of analytical perspectives. Not only can we focus on institutional mechanisms, potential risks, policy effects, and so on, but can also dynamically depict the entire process of policy implementation, utilization of funds, and exercise of authority with the help of big data audit.

3.3.3 Multi-relationship.

With diverse data relationships, big data audit involves different departments, fields, systems, government levels, and regions. These data sources are related to each other, making it easier to understand the real situations and resolve the problem of information asymmetry.

3.3.4 Multi-technique.

Big data audit includes a series of new techniques and methods in data collection, storage, and management as well as data mining and analysis. For data collection, in addition to

extract-transform-load tools, various new techniques, such as web crawlers, geographic remote sensing, and sensors are utilized. For data storage and management, the centralized structure is substituted by distributed structure (such as Hadoop). Data mining and analysis has developed from simple statistics to smart and visual methods.

3.3.5 Multi-mode.

Big data audit can be conducted on-site, off-site, or a combination of both. A variety of approaches, such as centralized data collection, remote auditing, and online auditing, can be used flexibly. Not only can it provide analysis results for on-site audits, big data analytics, through regular data updates, can also monitor major risk areas.

3.4 The Role of Big Data Analytics in the Fulfillment of SAIs' Duties

Over the years, in line with the principles of the Lima Declaration, Mexico Declaration, and Beijing Declaration, SAIs have played a key role in effectively improving the performance of the public sector, in strengthening good governance, transparency, and accountability; fighting corruption, and in promoting sustainable development under their mandates.

Nowadays, technological, economic, and social development   has led to the exponential growth of data, making data a basic strategic resource for nations. Obtaining access to data, analyzing data, and developing insights will continue to be an essential part of SAIs' work. Big data audit provides a new method to improve the quality and efficiency of audit in the following ways:

3.4.1 To break resource limitations, improve audit efficiency, and expand audit coverage

Under the constraints of human resources, budgets, and time, SAIs have, for a long time, relied on audit sampling to infer overall audit results. Subsequently it is difficult to expand the audit scope or increase sampling frequency. However, the use of big data provides new solutions for auditors. Through data mining and analysis, an smart, all-data audit model where "sample equals population" has been made possible in some cases. The use of technology during auditing has proved effective to untie resource constraints.

First, big data audit could conduct analysis before on-site audit and enhance the accuracy of on-site auditing, thereby shortening field work time. Second, big data audit could carry out monitoring to see if an entity has improved or maintained its performance, thereby improving the quality of audit work.

3.4.2 To improve SAIs' ability to issue early warnings about economic and social risks

Conventional sampling-based audit approaches are sufficient for assurance purposes, but they fail to provide the levels of description and prescription that are necessary to fully understand the interacting causes, the resulting effects, and the most efficient improvements to put governments on a more efficient and results-driven path. However, big data audit is helpful to:

- deliver more objective, reliable, and timely information through data analysis;

- identify potential risks in the economy and society through predictive analysis; and

- provide recommendations to decision-makers on a wider scale through in-depth analysis.

3.4.3 To broaden the horizon of SAIs; to promote sustainable development of countries

In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development, which defined 17 sustainable development goals. The SAIs, by following closely on their nation's sustainable development strategies and tracking relevant policy implementation, allocation and use of public funds, and the exercise of public power, can facilitate the building of a transparent, clean, and efficient government, promote good governance, and help realize sustainable economic and social development.

Big data audit makes it possible to follow the trace of economic activities in digital circumstances, so that SAIs can evaluate the performance, transparency, and accountability of the public sector in a more accurate and prompt manner, and ultimately facilitate the implementation of the United Nations' 2030 Agenda for Sustainable Development.

Acknowledging the significance of big data audit, SAIs should also recognize the following:

- We should not ignore the importance of the conventional data and traditional analytic methods that would still serve as the basis for audit.

- The effectiveness of using big data technology depends on the audit type and specific audit objectives.

- For big data audit, there remains considerable variation in the quality of data collected, the extent of reliance on data and analytics, and the complexity of the methods applied.

3.5 Challenges Faced by Big Data Audit and Coping Strategies of SAIs

With the feedback from 64 SAIs, we realized that the practices of different SAIs' use of information technology vary, especially in big data analytics. Some SAIs mainly analyze financial data, some analyze operating and management data on a wider scale, while others have explored the integration of data from multiple fields.

Despite the different conditions of countries, the challenges faced by SAIs are mainly manifested in two aspects. The first aspect is from a domestic perspective. The SAIs usually encounter a series of challenges in big data thinking, audit organization models, expertise, and IT infrastructure. The most common problems are insufficient professionals and technical challenges. The second aspect of challenges comes from the external environment. There might still be some barriers related to obtaining data for SAIs.These barriers may be technical issues, costs, data anonymization, quality, and delays. In practice, obstacles occasionally emerge from the audited entities in order to avoid providing the SAI with data appropriate for a complete and in-depth analysis. In response to these challenges, we propose the following coping strategies:

3.5.1 Develop long/medium/short-term planning for big data audit.

In view of the level of digitization and SAIs' mandates, SAIs should keep abreast of the current situation and follow appropriate big data technologies in the long run..

3.5.2 Step up IT application in auditing.

At present, IT application is closely linked to the performance of big data audit, and it differs greatly among SAIs. It is suggested that, in light of SAIs' respective circumstances, IT application be strengthened step by step and that solid technical guarantees be provided for big data audit through data centres, analysis platforms, and innovations in data tools.

3.5.3 Strengthen the professional standards of auditors and upgrade audit organization and management methods.

At present, big data expertise is generally lacking in SAIs. It is recommended that SAIs make greater efforts to enhance the overall competence of the audit team and ensure the capability of professionals. A big data analysis team or agency could be set up, to help transform the audit organization from on-site audit to the combination of on-site audit and off-site data analysis.

3.5.4 Accelerate not only the promulgation, but also the implementation of laws and regulations.

Data should be recognized as an important resource in the information era. It should be explicitly stipulated that SAIs is entitled to obtain data from the audited entities. The obligation of audited entities to cooperate and the punishments for those who refuse to provide data or provide untruthful data should also be stipulated.

3.5.5 Enhance regional and international cooperation.

Information sharing and experience exchanges in the area of big data audit at the institutional, regional, and INTOSAI level should be promoted. At the same time, SAIs should learn from the practices of stakeholders, especially other public sector institutions.

4. Conclusions and Recommendations

Based on the discussion above, we have drawn conclusions and recommendations as follows:

4.1 Information technology, represented by digitization, networking, and intelligence is transforming people's lives and has become an important tool for modernizing the governance system and enhancing administrative capabilities of countries. As the core and most important part of national governance, public administration relies on information technology to improve the quality of public services and improve the public sector's awareness of risk factors, prediction and management capabilities. This is an inevitable choice.

4.2 Data is a fundamental strategic resource in public administration. Data, used efficiently, will

provide public administrators a more comprehensive and reliable basis for acting and responding proactively to current and emerging challenges in their respective countries. These data, collected in an efficient and effective manner, will enable public administrators to better understand the status of their country. In this process, interdepartmental data exchange and sharing is essential, and the government should ensure the security and reliability of data.

4.3 Data application for the improvement of public administration should be carried out within a well-designed framework from strategic planning to implementation. It is agreed that the most effective measures are to develop data strategies, strengthen capacity development, and strengthen collaboration among administrative departments. SAIs can and should take a leading role in demonstrating the critical importance of ongoing assessments improvements of data quality, and the practicality and efficiency of data analytics as a fundamental tool of governance.

4.4 The use of big data is an important means in improving SAIs' performance. Although SAIs face different internal and external environments at different stages of big data application, big data analytics is playing a varied but important role in improving audit efficiency and effectiveness and strengthening the performance of SAIs. Big data audit, characterized by multi-source, multi-perspective, multi-relationship, multi-technique, and multi-mode, can help SAIs evolve from audit sampling to the population, from audit parts to the whole, from micro to macro, and from ex post to concurrent and ex ante auditing. Big data audit can enhance the role of SAIs in improving performance, transparency, credibility, and accountability of the government in their countries. The ultimate purpose of big data audit is to promote good governance and sustainable development of society.
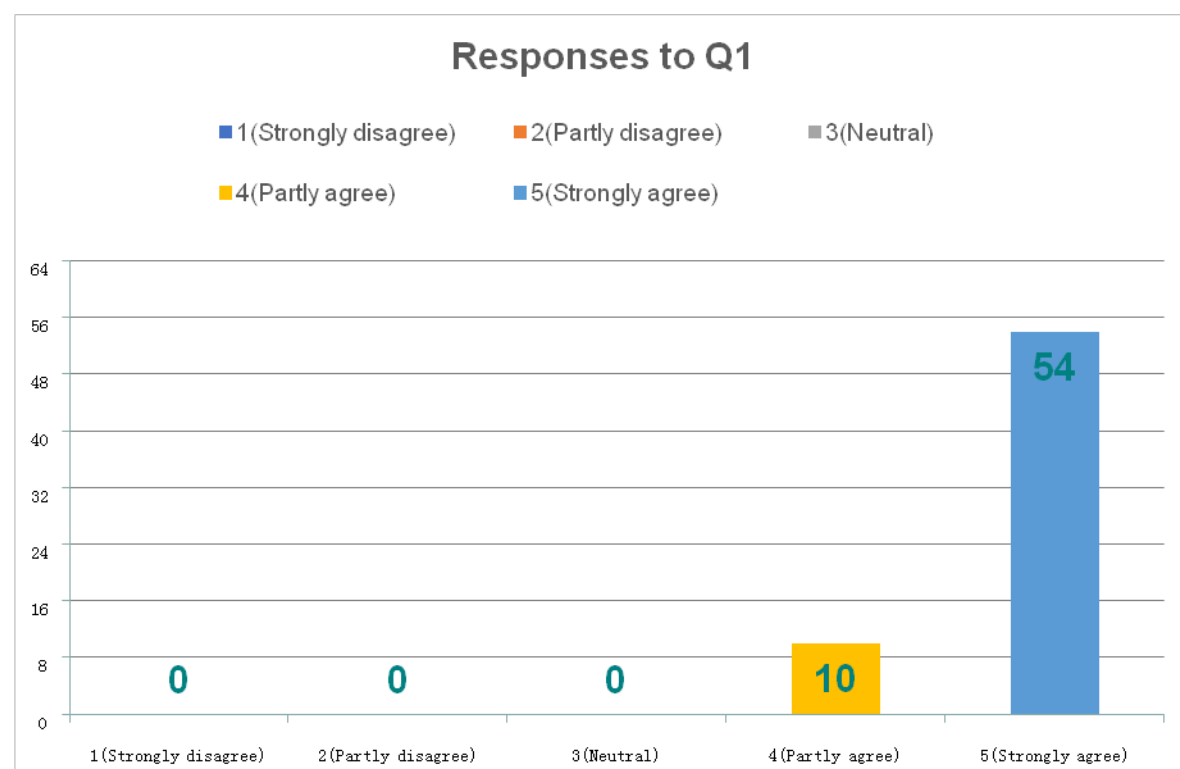
4.5 In SAIs' practice, big data audit is gaining more importance and developing rapidly on the basis of classical data and classical analytic methods. SAIs should face the challenges brought by big data audit and adopt active coping strategies, such as making long/medium/short-term planning for big data audit; developing an experienced team for data analytics; and introducing new techniques into the practice of government audit. Meanwhile, in order to ensure the implementation of big data audit strategy, enough resources need to be allocated to audit departments. Besides legal support, sufficient budgets and investments in IT audit are also needed.

4.6 As a professional organization advocating for public sector auditing, INTOSAI should strengthen the sharing of big data audit experiences. By strengthening bilateral and multilateral cooperation among SAIs as well as coordination and cooperation with relevant international organizations, INTOSAI can summarize big data audit experience and knowledge, develop relevant guidelines and research reports, and encourage SAIs to improve big data audit, so as to promote the development of big data audit within the INTOSAI community.

Annex

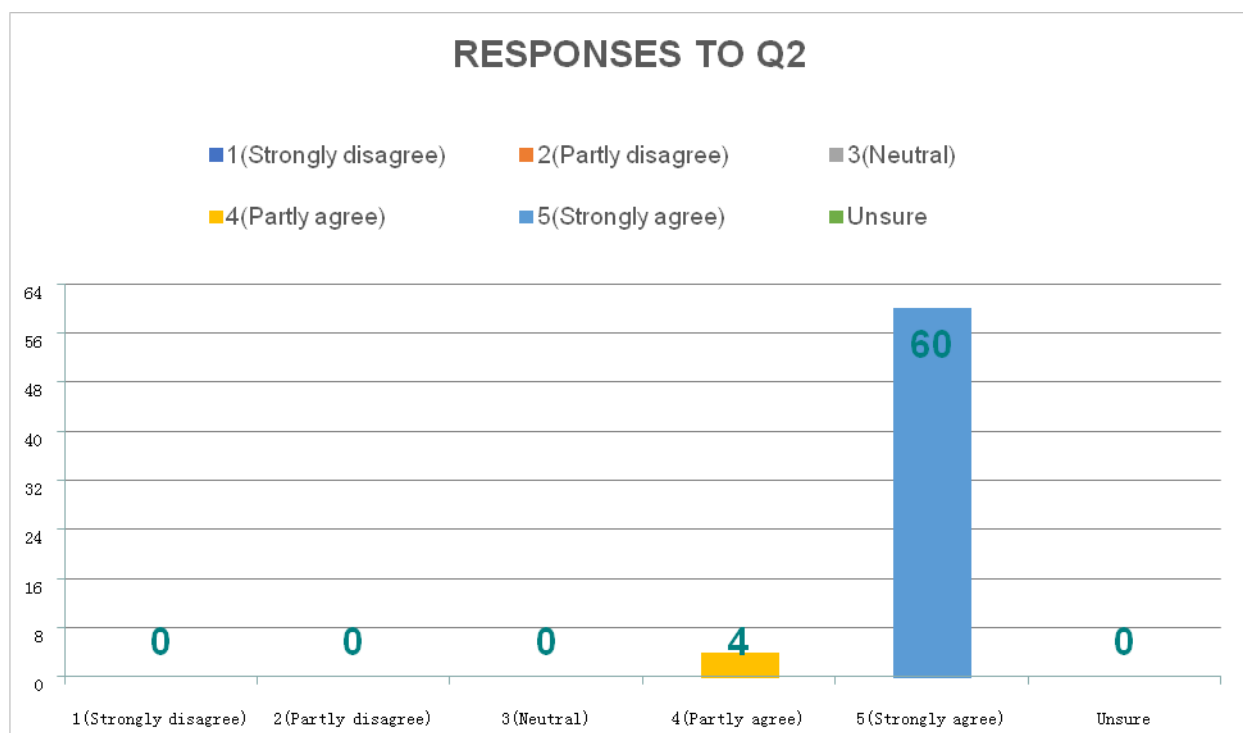# The Analysis of the Responses of SAIs to the Questionnaire

1. Do you think that data is a basic strategic resource in public administration?

All the responding SAIs agreed (strongly agreed or partly agreed) that data is a basic strategic resource in public administration. In additional remarks, most of the responding SAIs further pointed out that owing to the use of information technology, the government public sector in the information era can provide better public management services, and they stated that data is an important strategic resource in dealing with challenges and seizing opportunities. As *The Economist* comments, *the world's most valuable resource is no longer oil but is now data*. In addition, some SAIs emphasized that only high-quality data could serve public administration well.

2. Do you agree that more efficient use of data will improve public administration capabilities?
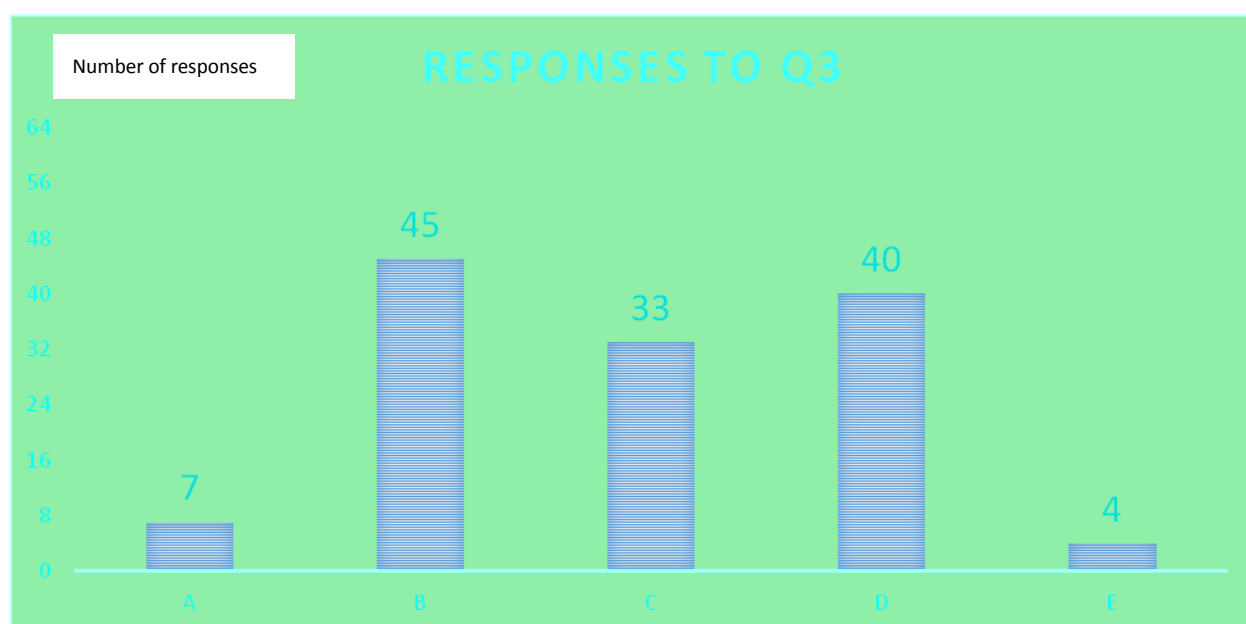
All responding SAIs agreed (strongly agreed or partly agreed) that more efficient use of data will improve public administration capabilities. In additional remarks, some responding SAIs further pointed out that authentic and reliable data can not only record the implementation process of the public sector, but also provide information for decision-making in the public sector. They also stated that data sharing in different fields and institutions and professional data analysis methods can more effectively promote the administrative capacity of public sectors.

RESPONSES TO Q2

■1(Strongly disagree) ■2(Partly disagree) ■3(Neutral)
■4(Partly agree) ■5(Strongly agree) ■Unsure

3. To what extent is information technology applied in your country's public administration?

(multiple choices)

According to the responses, most responding SAIs' countries were at the middle level of using information technology. 45 out of 64 respondents reported their country has adopted IT systems for public administration in most departments. 40 responding SAIs indicated that Internet public services were available in most departments. 33 responding SAIs reported that data sharing has been realized in some departments.

RESPONSES TO Q3

Number of responses

A. Merely office automation;

B. Most departments have adopted IT systems for public administration;

C. Some departments have realized data sharing;

D. Most departments now provide public services through the Internet;

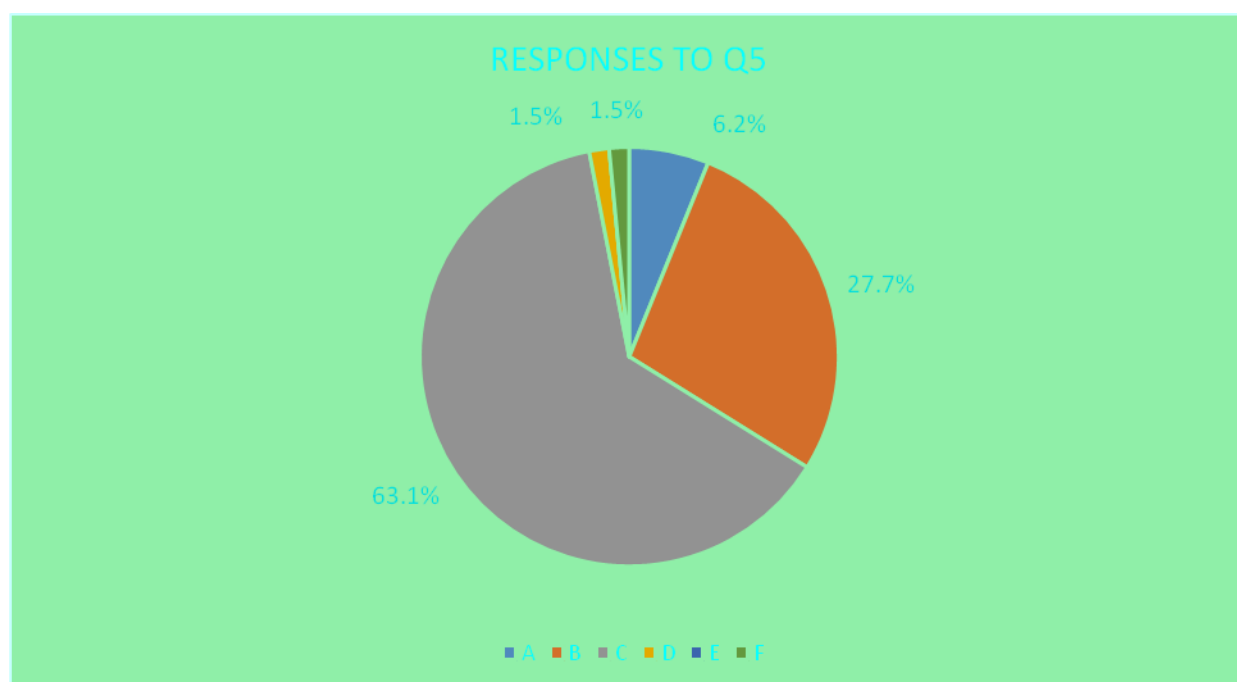E. E-government programs have NOT yet been launched.

4. Has your country enacted relevant laws, regulations, policies, etc. on data disclosure?

56 responding SAIs recognized that their countries had enacted relevant laws, regulations, policies, etc. on data disclosure. In additional remarks, some responding SAIs stated that data disclosure should be conducted under certain conditions: personal privacy and national and commercial secrets should be well protected.

5. At which level is the interdepartmental data exchange and sharing realized for the government departments in your country to exercise their responsibilities?

Most of the responding SAIs (63.1%) expressed that their countries were at a middle level, with interdepartmental data exchange and sharing realized for some government departments, while 27.7% of responding SAIs reported that data exchange and sharing had been implemented among most departments, and 6.2% of responding SAIs reported no obstacles to the data exchange and sharing between departments. In addition, 1 responding SAI expressed that there was a big gap in data sharing between different departments and regions and another 1 SAI was unsure about the condition.
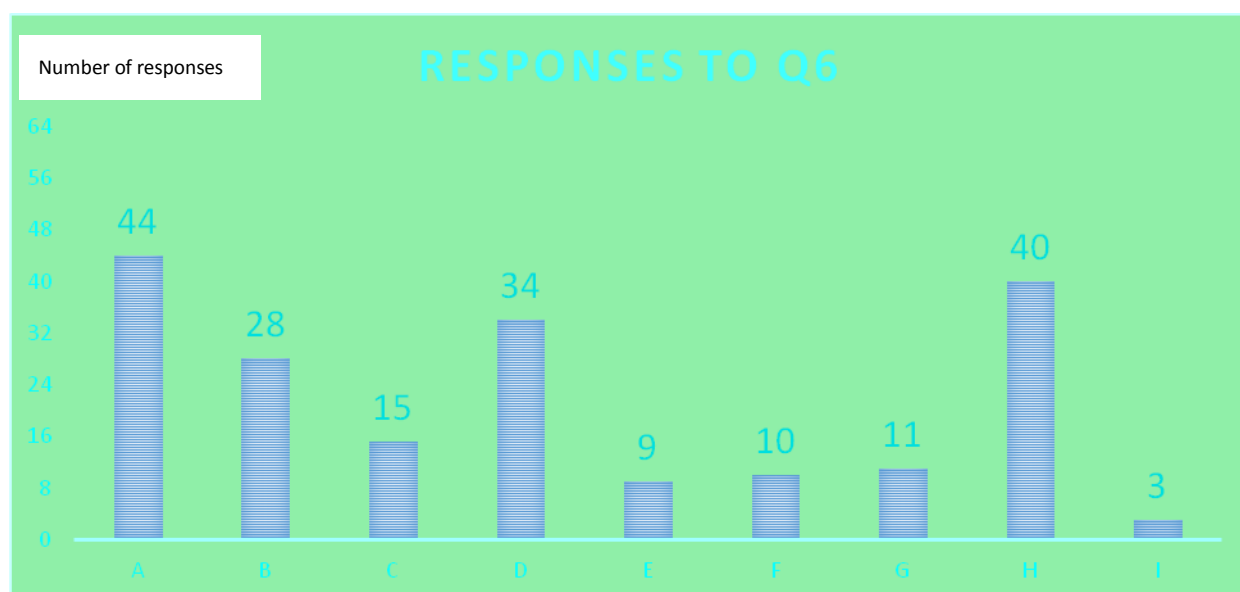
RESPONSES TO Q5

A. Very good. No obstacles to the data exchange and sharing between departments;

B. Fairly good. The exchange and sharing of data has been implemented among most departments;

C. OK. The data exchange and sharing has been implemented among some departments;

D. Poor. There is essentially no data exchange among departments;

E. Conditions lacking. No government department has yet adopted any IT system;

F. Unsure.

6. What measures do you think public institutions should take to promote data application?

(you may choose three measures at most)

Among the possible measures provided to promote data application in public institutions, the top three measures that most responding SAIs recommended were to 1) develop data strategies; 2) strengthen collaboration among administrative departments, institutions of higher learning and enterprises; and 3) strengthen capacity development. In additional remarks, some responding SAIs also proposed a focus on personnel training in capacity development.
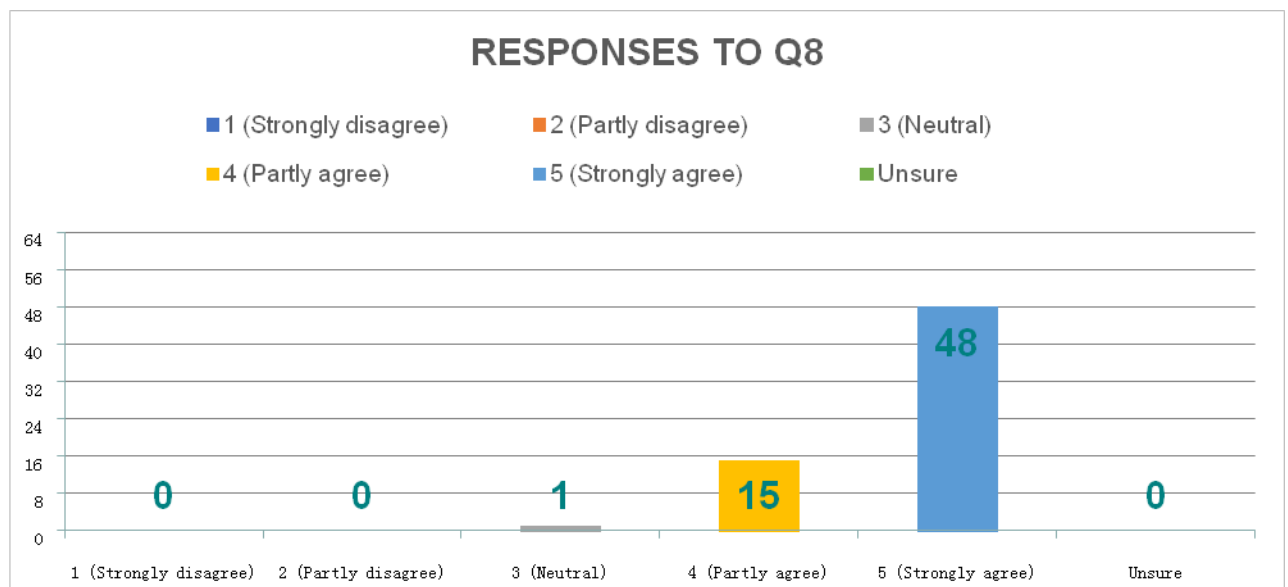
RESPONSES TO Q6

Number of responses

Category	Value
A	44
B	28
C	15
D	34
E	9
F	10
G	11
H	40
I	3

A. Develop data strategies;

B. Improve infrastructure;

C. Increase investment;

D. Strengthen capacity development;

E. Establish specialized agencies to promote data application;

F. Increase researches on data science;

G. Establish a data disclosure platform;

H. Strengthen collaboration among administrative departments, institutions of higher learning and enterprises;

I. Strengthen international exchanges.

7. Please describe the typical areas and cases in which data facilitates public administration in your country (additional pages may be attached).

60 responding SAIs gave detailed descriptions about the typical areas and cases in which data facilitated public administration in their countries. Generally speaking, most executive authorities in these countries have used information systems to manage part of their main processes and activities; as a result, they perform electronic administrative services. The typical areas and cases mainly concerned tax collection, passport application, visa requests, provision of health services, social insurance, government budgeting, finance, and physical resource management.
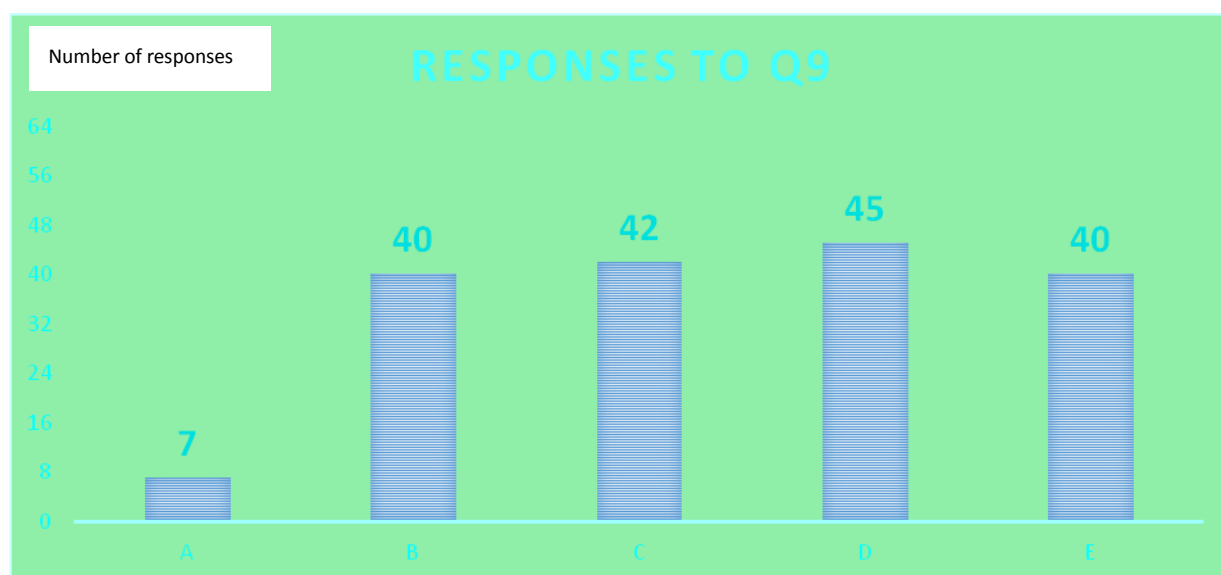
8. Do you agree that the use of big data is an important means of improving the performance of the supreme audit institutions (SAIs)?

Almost all (98%) of responding SAIs agreed (strongly agreed or partly agreed) that the use of big data is an important means of improving the performance of the supreme audit institutions. In additional remarks, some responding SAIs pointed out that big data technology and methods were conducive to the scientific development of audit plans and risk assessment, assisting in analysis before on-site audits, and enhancing the accuracy of on-site audits, thus shortening fieldwork hours. Some respondents stated that big data auditing could help them carry out regular monitoring, as well as improve the quality of their audit work. Some SAIs provided reminders not to ignore the importance of classic data and classic analytic methods that would still be the basis for an audit. Moreover, respondents stated that the effect of using big data technology would depend on the audit type and specific audit objectives.

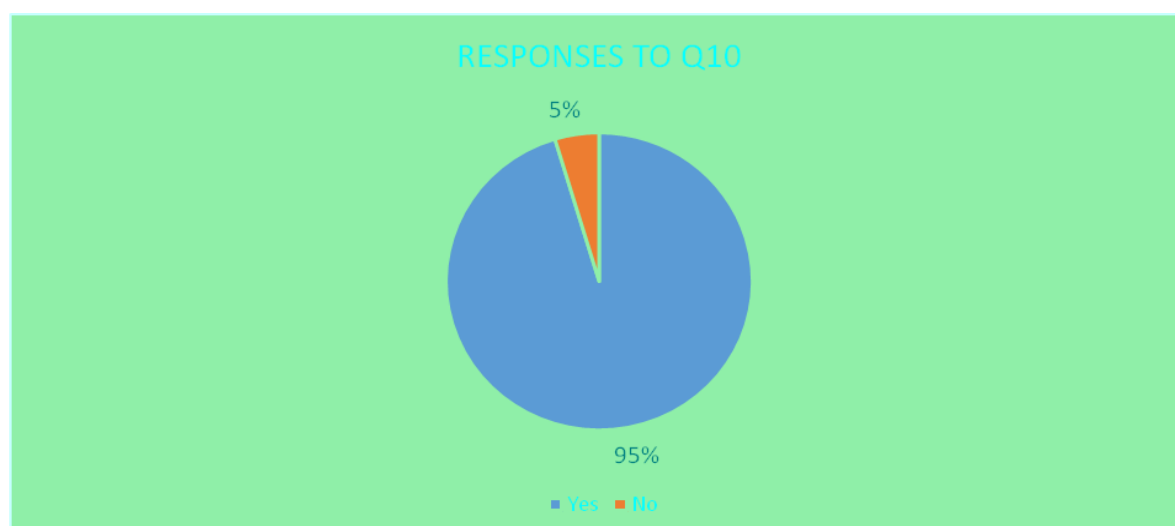**9. How does your SAI apply IT?** (multiple choices)

Most responding SAIs had the basic IT technology application conditions, with only 7 out of 64 responding SAIs at the beginning stage of building the technical infrastructure. In terms of technology application, the application of office automation software, audit software, database software, and data analysis tools were relatively common. In additional remarks, some common software that respondents mentioned they used were ActiveData, IDEA, Idea Pro and ACL, DATEV, EViews, Huddle, OAK, R, Python, and Tableau, etc.

RESPONSES TO Q9

Number of responses

A. Still building the technical infrastructure, and not applied yet;

B. Office automation;

C. Use specialized audit software to carry out audits;

D. Use databases to conduct audits;

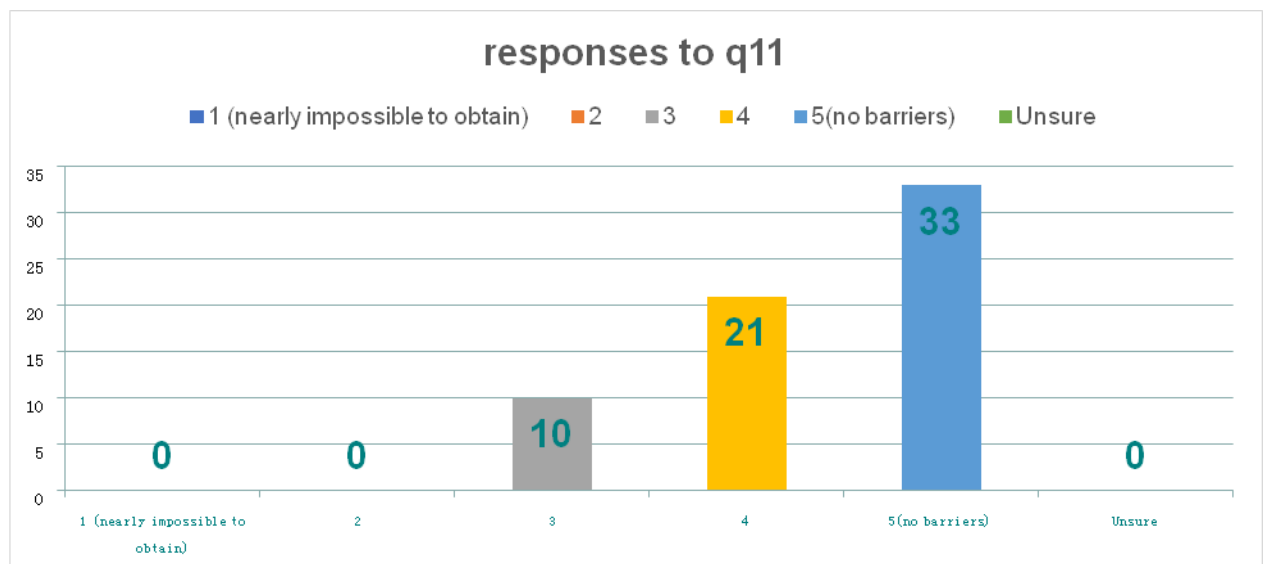E. Use data analysis tools to conduct audits, such as statistics software or data mining tools.

10. Please state whether your country has enacted relevant laws, regulations or policies to ensure the SAI's power to acquire audit data.

Most (95%) of the responding SAIs stated that their countries had enacted relevant laws, regulations, or policies to ensure the SAI's power to acquire audit data. In additional remarks, some responding SAIs that had not yet been authorized by relevant laws and regulations also stated that their countries were pushing forward relevant legislation.
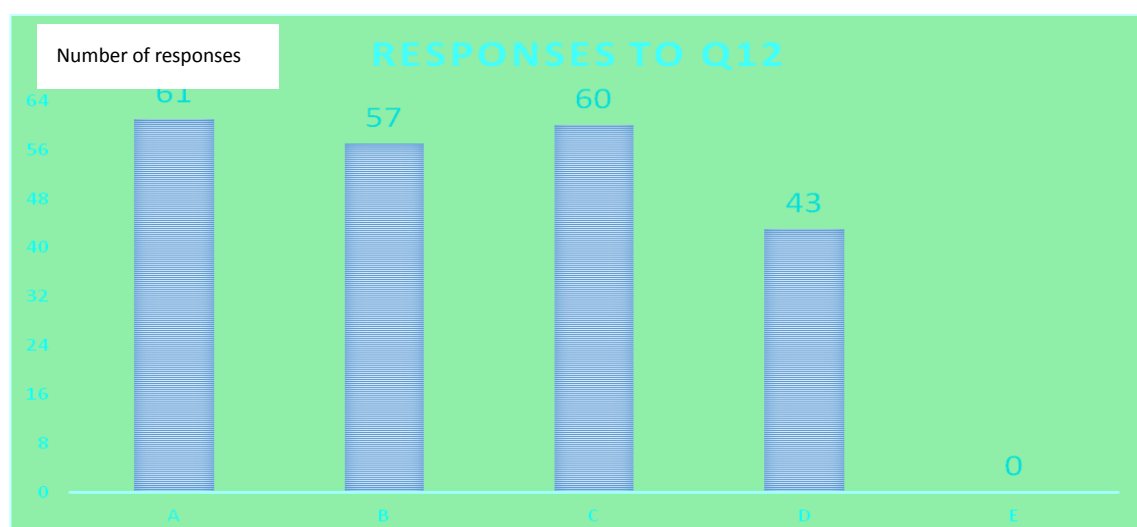

RESPONSES TO Q10

5%

95%

■ Yes ■ No

11. Please describe the situation of your SAI to obtain data from audited entities according to law.

All the responding SAIs agreed that there were few or no obstacles to obtaining data from the audited entities according to laws and regulations. And more than half (51%) of the responding SAIs stated they had no barriers to obtain data at all. In additional remarks, some SAIs mentioned that some obstacles still existed in obtaining data, including technical, cost-related, and data quality factors; data anonymization; and delays.

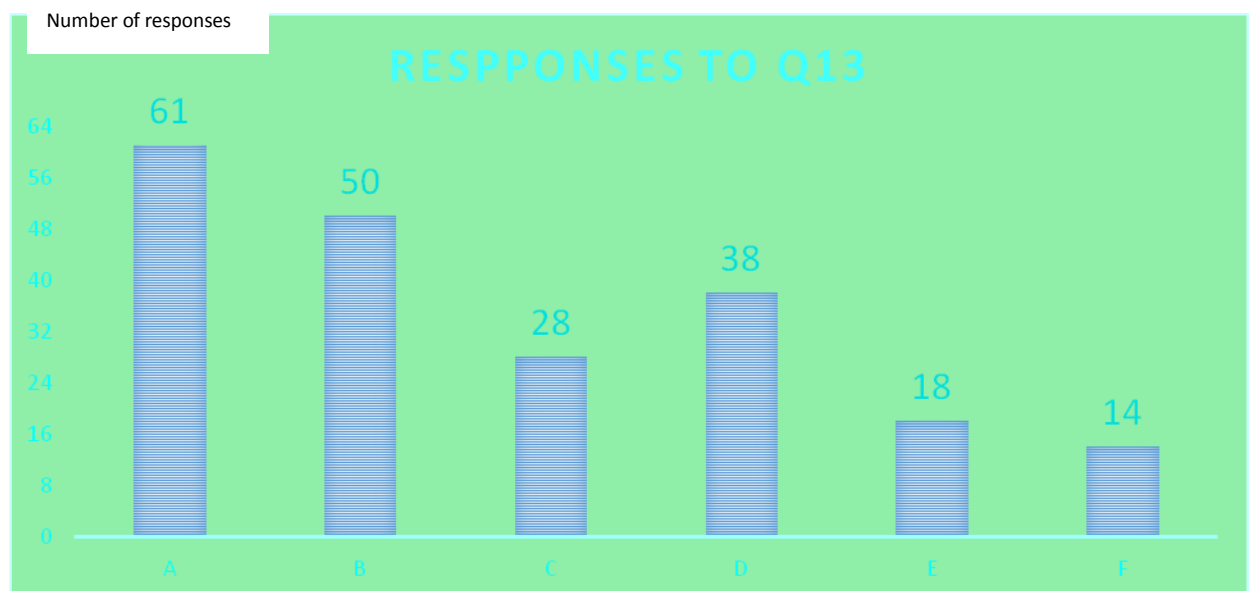**12. What kind of data is generally used by your SAI?** (multiple choices)

Financial information, management information, transactional information, and Internet information, respectively, were the top data types used by the responding SAIs. In additional remarks, some of these SAIs stated that Internet information was more useful than other kinds of information in the audit planning process. Moreover, they stated that a wide range of other information might be needed for specific types of audit, such as performance audit.

A. Financial information;

B. Transactional Information;

C. Management information (human resources, official documents, regulations, etc.);

D. Internet information (news web pages, social media etc. relating to the audited entities);

E. No use.

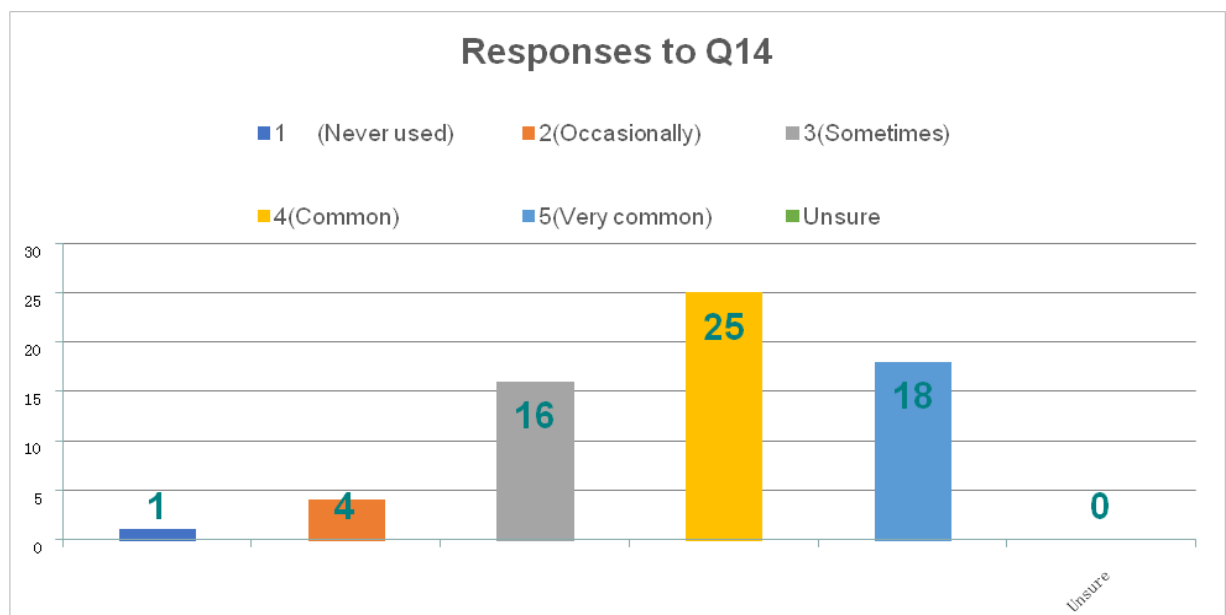**13. What data analysis techniques and tools are mainly used by your SAI?** (multiple choices)
From the results, basic data analysis tools like Excel and specialized auditing tools like IDEA were commonly used among the responding SAIs to carry out data analysis. Statistical analysis software like SPSS and SQL query were applied in around half of the 64 responding SAIs. In additional remarks, some responding SAIs with good data foundations stated that they have started using C, R, Python, and other advanced big data analysis tools.

A. Excel;

B. Specialized auditing tools (such as ACL, IDEA, AO);

C. Statistical analysis (SPSS, SAS, etc.);

D. SQL query;

E. Data mining (SPSS, SAS, etc.);

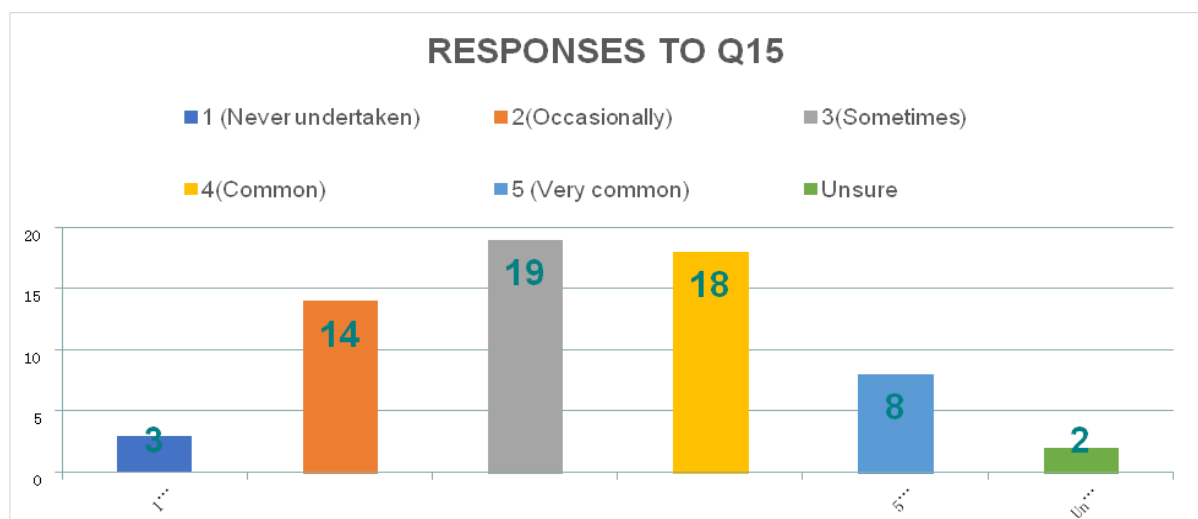F. Analysis Language such as C, R, Python.

14. To what extent have data analysis techniques and tools been used in your SAI?

Two thirds (67%) of the responding SAIs considered their use of data analysis techniques and tools to be "common" or "very common," while 31% of the responding SAIs have sometimes or occasionally used data analysis techniques. In additional remarks, some responding SAIs mentioned that whether to use data analysis techniques and tools or not would mainly depend on the type of audit, since such techniques are better used to make predictive analysis.
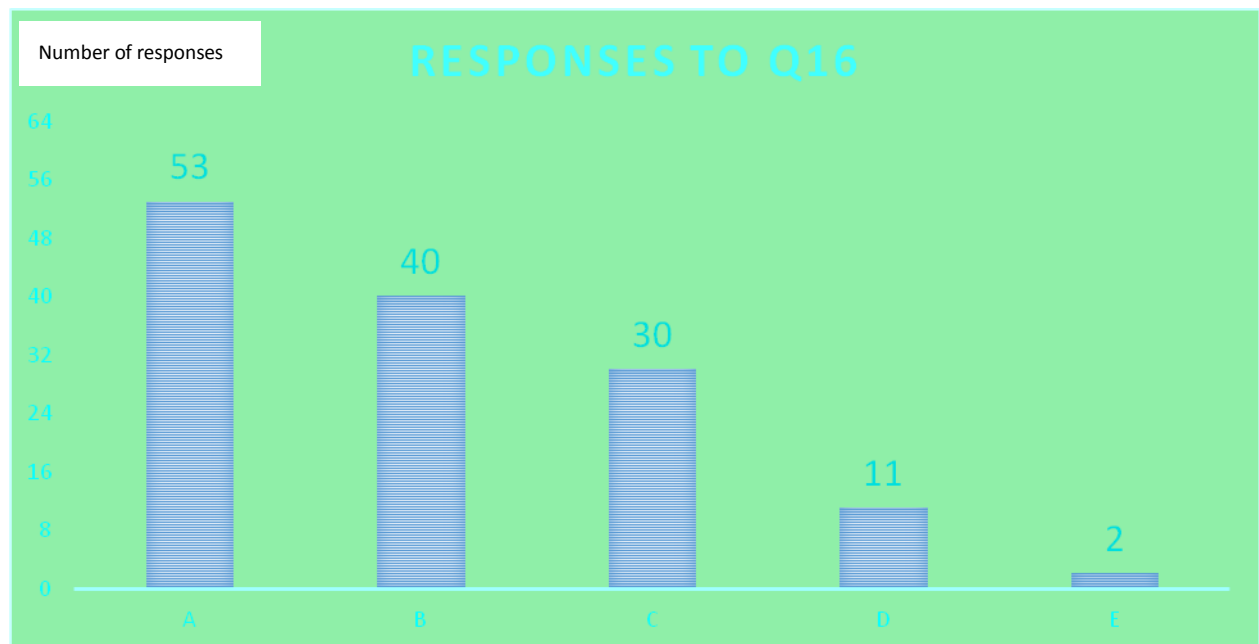

15. Please describe to what extent your SAI undertakes composite analysis of data from multiple departments.

40% of the responding SAIs rated a "common" or "very common" level of undertaking composite analysis of data from multiple departments, while another 52% of the responding SAIs reported having practices and experiences of doing such analysis at a lower frequency. Only few SAI had never had the experience.

16. Which of the following methods are used by your SAI during data analysis? (multiple choices)

Most of the responding SAIs had launched data analysis, and data analysis at the audit site was the most common choice among the methods. More than half of the 64 responding SAIs had undertaken off-site centralized analysis with data stored in the audit institution in a unified manner. Another 30 responding SAIs indicated that they had access to the IT systems of the audited entities for data analysis. In additional remarks, some responding SAIs mentioned that they considered specific methods based on working convenience and audit security.

A. Data analysis at the audit site;

B. The data of the audited entity is stored in the audit institution in a unified manner for centralized analysis;

C. Remote access to the IT systems of the audited entities for data analysis;

D. Networking with the audited entities to achieve continuous data transmission and analysis;

E. Not yet launched.

17. What role do you think big data analytics can play in the work of the SAIs? (multiple choices)

All the responding SAIs agreed on the positive effects of big data analytics for the work of SAIs. The results showed fairly even support for each choice, which could lead to the conclusion that big data analytics is considered to be conducive to

- improving audit efficiency;
- more accurate identification of clues to problems;
- foresight in auditing to identify risks;
- the analysis of the overall situation in a specific area; and

- expanding audit coverage to audit more funds, projects, and audited entities.

Number of responses

RESPONSES TO Q17

A chart showing responses to Q17 with the following values:
- A: 54
- B: 50
- C: 52
- D: 45
- E: 43
- F: 0

A. Conducive to improving audit efficiency;

B. Conducive to more accurate identification of clues to problems;

C. Conducive to foresight in auditing to identify risks;

D. Conducive to the analysis of the overall situation in a specific area;

E. Conducive to expanding audit coverage to audit more funds, projects and audited entities;

F. No obvious effect.

18. What do you think are the main problems facing the development of IT audit in your country?

(multiple choices)

According to the results, the most common problems with the IT audit development of SAIs were "technical challenges" and "lack of corresponding professionals." "Lack of top-level design for IT audit" and "insufficient budget and investment in IT" were also considered to be main problems by nearly one third of the 64 responding SAIs. In additional remarks, some responding SAIs stated that cost effectiveness was a restriction in using the IT audit approach.
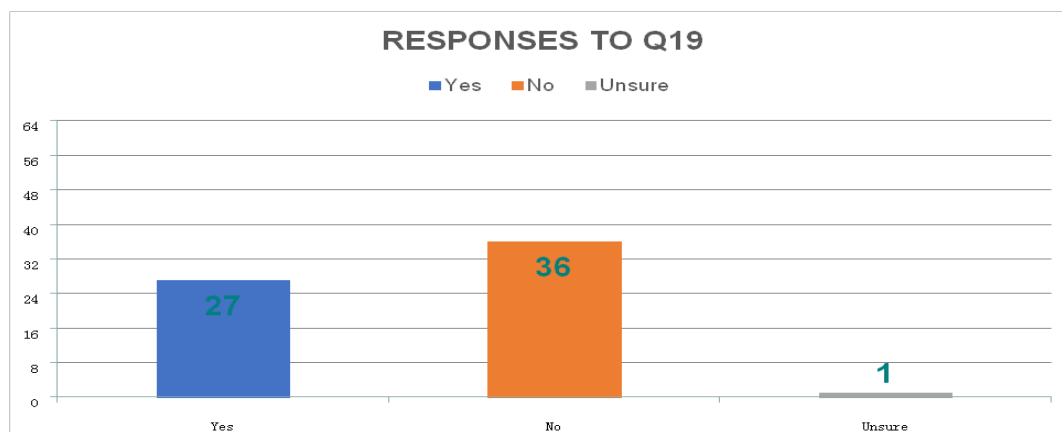
Number of responses — RESPONSES TO Q18

A. Lack of relevant legal support;

B. The overall IT application in the country restricts the development of IT audit;

C. Lack of top-level design for IT audit, or poor implementation of IT audit plans;

D. Insufficient budget and investment in IT;

E. Lack of corresponding professionals;

F. Lack of computer auditing tools;

G. Methods of audit organizations;

H. Difficulties faced in the application and dissemination of IT audit technology;

I. Technical challenges, such as semantic differences of data from different sources, diverse

technological environment.

19. Please state whether your SAI has ever conducted a big data audit?

If you select 'Yes', please describe the typical areas and cases in which your SAI conducts big data

auditing (additional pages may be attached).

42% of the responding SAIs indicated that they had carried out big data auditing.

RESPONSES TO Q19

In additional remarks, some responding SAIs stated that they applied big data audit methods in areas with good basic conditions of data, such as government operations, government finance and budgeting, and social services, while some SAIs had been able to build behavioral models through big data analysis to find abnormal transactions to fight against fraud and corruption.

Those respondents that had carried out big data auditing shared some cases. These cases were mostly in the government sector and relating to social services.

SECTORS IN WHICH RESPONDENTS SHARED CASES OF BIG DATA AUDITS