

**Global Curriculum
for
Information Technology Audit**

2022



INTOSAI
Working Group on IT Audit



INTOSAI
Goal Chairs
Collaboration
PSC – CBC – KSC

Quality Assurance Certificate of the Chair of the INTOSAI Working Group on Information Technology Audit (WGITA)

This is to certify that *Global Curriculum for Information Technology Audit* which is placed at level **2 (two)** of Quality Assurance as defined in the paper on “Quality Assurance on Public goods developed outside Due Process” approved by the INTOSAI Governing Board in November 2017 has been developed by following the Quality Assurance processes as detailed below:

- i. The project proposal was developed by the team in consultation with INTOSAI WGITA members;*
- ii. The project was discussed during the 30th and 31st annual WGITA meeting, held virtually, in 2021 and 2022, respectively;*
- iii. A draft curriculum as well as a need-gap analysis survey were circulated to the INTOSAI community on 19 August 2021 and were exposed for 50 days (from 19 August 2021 to 8 October 2021) for review and feedback. Feedback received was duly considered for finalization of the document.*
- iv. The finalized draft Global Curriculum was hosted on the WGITA website and was circulated to WGITA members in May 2022. Additional feedback received was duly considered for the final product.*

The product developed is consistent with relevant INTOSAI Principles and Standards. The structure of the product is in line with the drafting convention of non-IFPP documents.

The product is valid till **31 December 2027** and if it is not reviewed and updated by **31 December 2027** it will cease to be a public good of INTOSAI developed outside the Due Process.

Girish Chandra Murmu
Chair of INTOSAI Working Group on
Information Technology Audit



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Quality Assurance Certificate of the Chair of Knowledge Sharing and Knowledge Services Committee (KSC)

Based on the assurance provided by the Chair of the *INTOSAI Working group on Information Technology Audit (WGITA)* and the assessment by the Goal Chair, it is certified that *Global Curriculum for Information Technology Audit* which is placed at level **2 (two)** of Quality Assurance as defined in the paper on “Quality Assurance on Public goods developed outside Due Process” approved by the INTOSAI Governing Board in November 2017, has been developed by following the Quality Assurance processes as detailed in the Quality Assurance Certificate given by the Working Group Chair.

The product is valid till **31 December 2027** and if it is not reviewed and updated by **31 December 2027** it will cease to be a public good of INTOSAI developed outside the Due Process.

Girish Chandra Murmu
Chair of Knowledge Sharing and
Knowledge Services Committee

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1

Background – IT Audit Curriculum and IT Audit Courseware (2007)

WGITA had developed a curriculum for IT Audit and thereafter a complete set of courseware for IT Audit in the 1990's; and an updated version of the IT Audit Curriculum and IT Audit Courseware was finalized in [2007](#).

The scope of the curriculum was divided into seven areas:

- Planning an IT audit
- Assessing controls in IT systems
- Computer assisted audit techniques (CAATs), including microcomputer tools
- Auditing IT systems under development or procurement
- Undertaking performance audits of IT systems and functions
- Special assignments
- Reviewing and reporting the results of an IT audit

As the operating environment of Information Technology had seen substantial changes since 2007, a project was initiated to develop a Global Curriculum for IT Audit, replacing the IT Audit Curriculum for INTOSAI. The

project aims at bringing out a curriculum, identifying the detailed activities, grouped by domains/ subtopics in which skills and competencies are required from an auditor, who is to conduct audit of IT systems. Such competencies could be grouped to multiple levels (e.g. basic/ generalist, specialist IT auditor and advanced/ expert IT auditor); competencies in niche areas/ sector-specific competencies could also be identified as part of this curriculum.

The development of detailed courseware for this Global Curriculum for IT Audit is not part of the scope of this project.



2

Changes in IT paradigm

The rapid adoption of the different facets of IT across the globe, including across the public sector, is a self-evident phenomenon and the member SAIs are closely tracking this use and various INTOSAI Groups (e.g. EUROSAI ITWG, AFROSAI-E Working Group on IS Audit and Management) also keep abreast of these developments and brief the member SAIs on important developments. Many of the member SAIs also collect information about the major developments in their auditee universe proactively and take necessary action to build competencies to audit such developments.

A reference is invited to the UN-DESA E-government Survey 2020, which showed that

‘Many more countries and municipalities are pursuing digital government strategies, some of which are radically different from those guiding earlier e-government initiatives. Some of the new approaches Governments are taking in pursuit of digital government transformation include the delivery of e-government as a platform, the integration of online and offline multichannel delivery, the agile development of digital services (supported by whole-of-government and whole-of-society engagement and integration), the expansion of e-participation and partnerships, the adoption

of data-centric approaches, the strengthening of digital capacities to deliver people-centric services, and the innovative use of new technologies such as artificial intelligence (AI) and blockchain, especially in the development of smart cities.

..... E-government can bring services and engagement opportunities directly to people in remote or underprivileged communities, providing them with access at home or through digital kiosks in villages. E-government is not about services provision alone; it also plays a role in strengthening digital literacy (Goal 4), digital inclusion (Goals 5, 8 and 10), digital connectivity (Goal 9), and digital identity (Goal 16).

.....Since early 2020, the global COVID-19 pandemic has reinvigorated the role of e-government.'

A Global IPAC-Deloitte public sector executive survey in 2014 identified advanced analytics (for decision making) and mobile communications as key forces that are shaping various governments.

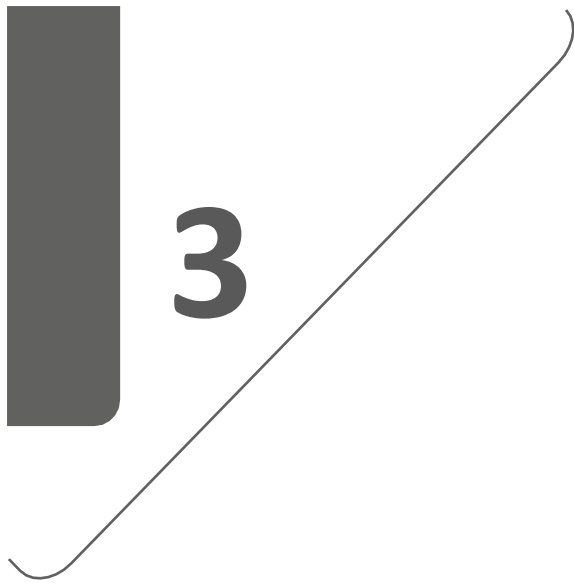
In a broad sense, we can summarise the developments as follows:

- Technology is now far more Internet and web-centric. Delivery of public services through digital means is now far more widespread. Cloud computing is now established. Use of technology (including mobile devices with internet access) is widespread across citizens all over the world, especially with extensive use of social media platforms.
- Internet and web-centric systems are far more exposed to information security risks on a global scale than in the past. Protection of privacy of individual citizen users, and the need for informed consent for permitting use of personal data (even if anonymized) is much better recognized and

also enforced through statutes and subsidiary regulation e.g. the European Union's General Data Protection Regulation (GDPR).

- There is far more attention being paid to IT governance and management (often distinguishing between IT governance and oversight at the Board or equivalent level and IT management at the executive level), and the need for fuller alignment with the organization's strategic goals and objectives is better recognized.
- The use of data analytics and Artificial Intelligence (Machine/ Deep Learning) in organizations (whether in the public or private sector) has increased exponentially, and the use of data driven (often algorithm based/ supported) decision-making is now well recognized. At the same time, ethical and legal considerations with regard to the use of AI in decision-making by government are also coming to the forefront.

SAIs the world over have both reacted to the increasing use of technology in the public sector and proactively made use of technology for making their audits more effective and efficient. Many SAIs are using data analytics tools and techniques – not just exception-based querying but also mining auditee and third party data to identify anomalies, outliers, trends and other insights; sometimes, such data analytics may include AI/ ML techniques to dynamically improve the efficiency of audit. Data analytics could be used to support the objectives of routine financial, compliance and performance audits, but could also be used to supplement the conventional testing of IT Controls. Other SAIs may face challenges in the audit of IT security or audit the deployment of new age technologies like cloud computing, SaaS and mobile apps in their auditee universe.



IT audit curriculum

The curriculum would be based upon two levels of IT audit skills- Level 1 (Basic/ Generalist) and Level 2 (Specialist). SAIs can identify Level 3 auditors (Advanced/ Expert) based on specialised expertise in specific areas and experience in the field of IT audits over several years.

Given the current changes, the areas for curriculum can be grouped as:

1. Technology components and architecture
2. IS governance and management
3. IS acquisition, development and implementation
4. IS application controls
5. IS operations and business resilience
6. Protection of information assets
7. IS auditing process

3.1 Technology components and architecture

Sl. No	Topic	Level 1	Level 2
1	Operating Systems		Y
2	Typical IT System Components: DMS (Document Management System); BPM (Business Process Management) Components; BI (Business Intelligence), RDBMS etc.	Y	Y
3	Operational technology (OT) and Industrial control systems		Y
4	ERP Systems	Y	Y
5	Mobile platforms/ apps		Y
6	Software models (Open Source, Open Standard, Open Architecture and Open Data models)		Y
7	Software Licensing Types		Y
8	Cloud Computing Basics (IaaS, PaaS, SaaS)	Y	Y
9	Network components and architecture		Y

3.2 Information systems: governance and management

Sl. no	Topic	Level 1	Level 2
1	Introduction to IT related frameworks	Y	Y
2	Capability maturity model		Y
3	Governance structure, strategic planning of IT in the public sector	Y	Y
4	IT risk management	Y	Y

3.3 Information systems: Acquisition, development and implementation

Sl. no	Topic	Level 1	Level 2
1	Project management	Y	Y
2	Business case and feasibility analysis	Y	Y
3	System Development Lifecycle phases	Y	Y
4	Software development methods	Y	Y
5	Infrastructure and applications acquisition	Y	Y
6	Testing methodologies and classification		Y
7	Change management and Post implementation review	Y	Y
8	Systems and data migration		Y
9	Challenges for IT projects in the public sector	Y	Y

3.4 Information Systems: application controls

Sl. no	Topic	Level 1	Level 2
1	Input controls	Y	Y
2	Processing controls	Y	Y
3	Output controls	Y	Y
4	Application security controls	Y	Y

3.5 Information Systems: operations and business resilience

Sl. no	Topic	Level 1	Level 2
1	Systems Performance Management		Y
2	Problem and Incident Management	Y	Y
3	Change control, Configuration, Release, and Patch Management		Y
5	Business resilience and impact analysis, business continuity and disaster recovery planning		Y
7	Data management, Backup and recovery		Y
8	Batch processing controls		Y

3.6 Protection of information assets

Sl. no	Topic	Level 1	Level 2
1	Concepts - confidentiality, integrity and availability	Y	Y
2	Information asset security frameworks and standards	Y	Y
3	Data privacy (models, comparative law, regulatory agencies) and principles for identifying and protecting personally identifiable information	Y	Y
4	Physical access and environmental controls	Y	Y

5	Identity and access management (including Privileged access management)		Y
6	Network and end-point security		Y
7	Data encryption and related techniques		Y
8	Information system attack methods, vulnerabilities and countermeasures		Y
9	System testing tools and techniques		Y
10	Security monitoring tools and techniques		Y
11	Security incident response management	Y	Y

3.7 Information systems auditing process

Sl. no	Topic	Level 1	Level 2
1	Risk-Based approach to IS Audit Planning	Y	Y
2	Control objectives and measures, types/ classification of controls	Y	Y
4	Audit process activities – audit planning, design, execution, reporting and follow-up	Y	Y
5	Gathering evidence in a digital environment	Y	Y
6	Data analytics and continuous auditing techniques ¹		Y
7	CAATs (including exception based querying)	Y	Y

¹ E.g. for use as part of substantive testing of application controls

3.8 Other areas for advanced learning

Other areas for advanced learning, which could be organised for Level 2 and Level 3 IS auditors include:

1. Statistical inference concepts for data analytics
2. Introduction to Data Science and Data Analytics (including tool-specific training), and Artificial Intelligence and Machine Learning:
3. Block Chain/ Distributed Ledger Technologies
 - a. Emerging abstract models for Blockchain Technology
 - b. Use cases