

CASE STUDY

Application of the IAEA TOSCA Methodology in Armenia

Strengthening the National Nuclear and
Radiation Safety Regulatory Infrastructure
through TSO Self-Capability Assessment



ENHANCED
SAFETY



SUSTAINABLE
EXPERTISE



STRATEGIC
DEVELOPMENT



STRONG
PARTNERSHIP



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Republic of Armenia

REPORT INFORMATION

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Abbreviations and acronyms

Abbreviation / Acronym	Full Name / Explanation
ANPP	Armenian Nuclear Power Plant
ANRA	Armenian Nuclear Regulatory Authority
AOB	Any Other Business
FPP	Focal Point of Pillars
IAEA	International Atomic Energy Agency
LTO	Long Term Operation
NPP	Nuclear Power Plant
NRSC	Nuclear and Radiation Safety Center
OAR	Organization Assessment Respondent
OR	Organization Responsible
PDCA	Plan-Do-Check-Act
SMR	Small Modular Reactor
SWOT	Strengths, Weaknesses, Opportunities and Threats
TOSCA	Technical and Scientific Support Organization Self-Capability Assessment
TSO	Technical and Scientific Support Organization

Executive summary

This Case Study presents the experience of the Republic of Armenia in the application of the IAEA TOSCA (Technical and Scientific Support Organization Self-Capability Assessment) methodology for assessment and development of national technical and scientific support capabilities in the field of nuclear and radiation safety.

The implementation of TOSCA in Armenia represented the first comprehensive and systematic assessment of the Nuclear and Radiation Safety Center (NRSC) as the Technical and Scientific Support Organization (TSO) supporting Armenian Nuclear Regulatory Authority (ANRA). The assessment was conducted during June-November 2024 with participation of NRSC, ANRA and the IAEA expert team.

The Armenian implementation was performed not only as a self-assessment exercise, but also as a strategic capability development process aimed at evaluating the adequacy, sustainability and future readiness of the national technical support infrastructure.

The assessment was implemented within the broader national context of:

- long-term operation of the Armenian NPP;
- implementation of safety modernization programmes;
- development of radioactive waste management infrastructure;
- strengthening of radiation safety infrastructure;
- consideration of future nuclear power development options, including advanced reactors and SMRs.

The TOSCA implementation involved:

- organizational self-assessments;
- SWOT analyses;
- workshops and expert discussions;
- validation and consolidation activities;
- development of strategic and implementation-oriented Action Plans.

The assessment process included separate but coordinated perspectives from NRSC, ANRA and the IAEA expert team. This enabled evaluation of both internal organizational capabilities and the effectiveness of technical support provided to the Regulatory Body.

The Armenian implementation demonstrated that TOSCA can serve not only as an assessment methodology, but also as:

- a strategic planning instrument;
- a capability development framework;
- a national organizational learning mechanism;
- a structured approach for strengthening sustainable regulatory infrastructures.

The implementation also generated practical experience, lessons learned and methodological observations related to:

- organization of the assessment process;
- stakeholder coordination;
- sustainability of technical expertise;
- competence and knowledge management;
- integration of TOSCA outputs into strategic planning;

- transformation of findings into practical and implementation-oriented actions;
- development of organizational and national Action Plans;
- long-term sustainability of TSO capabilities.

These experiences demonstrated the value of TOSCA as a comprehensive tool supporting continuous improvement, capability development, strategic planning and long-term sustainability of regulatory and technical support infrastructures.

The results of the Armenian implementation confirmed the importance of maintaining technically competent, independent and sustainable TSOs capable of supporting evolving regulatory responsibilities and future nuclear and radiation safety challenges.

This Case Study is intended to preserve institutional knowledge, support future re-assessment activities, contribute to international knowledge sharing and provide practical experience for the IAEA Member States considering implementation of the TOSCA methodology.

1. Introduction

The effective implementation of nuclear and radiation safety regulation requires not only a competent and independent Regulatory Body, but also sustainable scientific and technical support arrangements capable of providing objective, reliable and evidence-based technical input to regulatory decision-making.

Requirement 20 of the IAEA General Safety Requirements Part 1 (Rev. 1), “Governmental, Legal and Regulatory Framework for Safety” establishes that the Regulatory Body shall obtain technical or other expert professional advice or services as necessary in support of its regulatory functions, while retaining full responsibility for regulatory decisions. In practice, this requirement is commonly fulfilled through TSOs, particularly in technically complex and safety-significant fields such as nuclear and radiation safety.

In the Republic of Armenia, technical and scientific support to the ANRA is provided by the NRSC, functioning as an independent external TSO under formal contractual arrangements with ANRA. NRSC was established by the Government of the Republic of Armenia in 2001 to provide scientific and technical expertise in the field of nuclear and radiation safety.

Over the years, NRSC expanded its technical support activities in accordance with the evolving needs of the national nuclear and radiation safety programme. The increasing complexity of regulatory responsibilities, together with the need to ensure long-term sustainability of technical expertise and analytical capabilities, created the need for a comprehensive and systematic evaluation of the national technical support infrastructure.

The implementation of the IAEA TOSCA methodology in Armenia was therefore initiated to evaluate whether the existing organizational arrangements, competence management systems, technical support capabilities and long-term sustainability mechanisms remain adequate to support current and future regulatory needs associated with the evolving nuclear and radiation safety programme of the Republic of Armenia.

The Armenian implementation of TOSCA was conducted during June-November 2024 with participation of NRSC, ANRA and the IAEA expert team. The assessment represented the first comprehensive evaluation of NRSC’s performance and sustainability as a TSO since its establishment in 2001.

The implementation was viewed not only as an assessment exercise, but also as:

- a strategic organizational development process;
- a capability sustainability assessment mechanism;
- a framework for long-term planning and improvement;
- a tool for strengthening the national regulatory infrastructure.

The assessment was implemented using structured questionnaires, evidence-based evaluation, SWOT analyses, workshops, validation activities and Action Planning processes. Separate assessment perspectives were developed by NRSC, ANRA and the IAEA expert team, allowing evaluation of both organizational capabilities and effectiveness of technical support provided to the Regulatory Body.

The Armenian experience demonstrated that TOSCA can provide substantial value when implemented as a coordinated national exercise integrating assessment, strategic

planning, capability development and long-term sustainability considerations within the national nuclear and radiation safety infrastructure.

2. Objectives and background for development of the Case Study

The objective of this Case Study is to document, analyze and present the experience of the Republic of Armenia in the application of the IAEA TOSCA methodology for assessment and development of national technical and scientific support capabilities in the field of nuclear and radiation safety.

The Case Study is intended to (Figure 1):

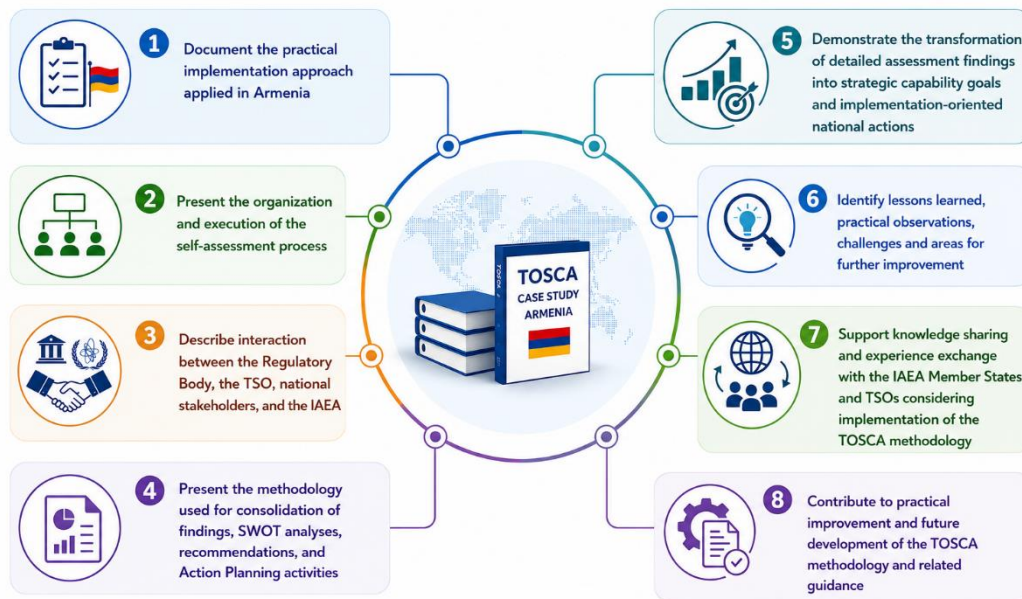


Figure 1. Objectives of the Armenian TOSCA Case Study

The Republic of Armenia operates a nuclear and radiation safety programme that includes long-term operation of the Armenian NPP, implementation of safety enhancement programmes, development of radioactive waste management capabilities, expansion of radiation safety infrastructure and consideration of future nuclear power development options, including advanced reactors and SMRs. These developments create increasing demand for sustainable regulatory support, specialized expertise, competence and knowledge management, analytical and laboratory infrastructure, and long-term preservation of technical capabilities.

In this context, Armenia implemented TOSCA as a structured self-assessment and capability development process involving the ANRA, the NRSC acting as the external TSO to ANRA, and the IAEA expert team. The implementation included organizational self-assessments, structured discussions, SWOT analyses, validation and consolidation activities, and development of strategic and implementation-oriented Action Plans.

The application of TOSCA was connected to the need to assess whether existing TSO capabilities, organizational arrangements and support mechanisms are sufficiently robust to support ANRA in both current regulatory functions and future tasks associated with the long-term development of the national nuclear and radiation safety programme.

During implementation, Armenia accumulated practical experience related to assessment organization, stakeholder coordination, interpretation and application of the methodology,

strategic Action Planning, and integration of TOSCA outputs with national programme needs. The process also generated lessons learned, methodological observations, practical challenges and proposals for further improvement of the TOSCA methodology and related guidance.

Preparation of this Case Study is therefore important for preserving institutional knowledge accumulated during implementation, ensuring traceability of assessment and Action Planning activities, supporting future re-assessment, strengthening continuity of national capability development processes, and sharing practical experience with other IAEA Member States considering TOSCA application.

The Armenian implementation demonstrated that TOSCA provides the greatest value when applied not only as a self-assessment methodology, but also as a strategic planning framework, a capability development mechanism, a continuous improvement process and a practical instrument for strengthening long-term sustainability of regulatory and technical support infrastructures.

Accordingly, this Case Study is intended to serve as documentation of the Armenian implementation experience and as a practical reference for future national re-assessments, strategic planning activities, knowledge management, training and international experience sharing related to TSO capability development and sustainability.

Note on applicability

This Case Study presents the experience gained during the first application of the IAEA TOSCA methodology in Armenia. It reflects the specific organizational arrangements, regulatory framework, national priorities, available resources and institutional relationships existing within the Armenian nuclear and radiation safety infrastructure at the time of the assessment.

The approaches, practices, observations, findings, lessons learned and recommendations described in this document are based on the Armenian experience and were developed in response to national circumstances and needs. While the Case Study may provide useful insights and practical examples for other organizations and IAEA Member States considering implementation of the TOSCA methodology, it cannot be assumed that the approaches applied in Armenia will be directly applicable, suitable or optimal in other national contexts.

Each organization and IAEA Member State should evaluate the applicability of the described approaches in light of its own regulatory framework, organizational structure, level of maturity, available resources and strategic objectives. The information provided in this Case Study is therefore intended to support knowledge sharing and exchange of experience rather than to establish prescriptive guidance or universally applicable implementation practices.

3. Armenian regulatory infrastructure and TSO model

3.1 Nuclear and radiation safety regulatory infrastructure and ANRA-NRSC interface

The nuclear and radiation safety regulatory infrastructure of the Republic of Armenia is based on functional interaction between the ANRA, acting as the national Regulatory Body, and the NRSC, acting as the external TSO to ANRA (Figure 2).

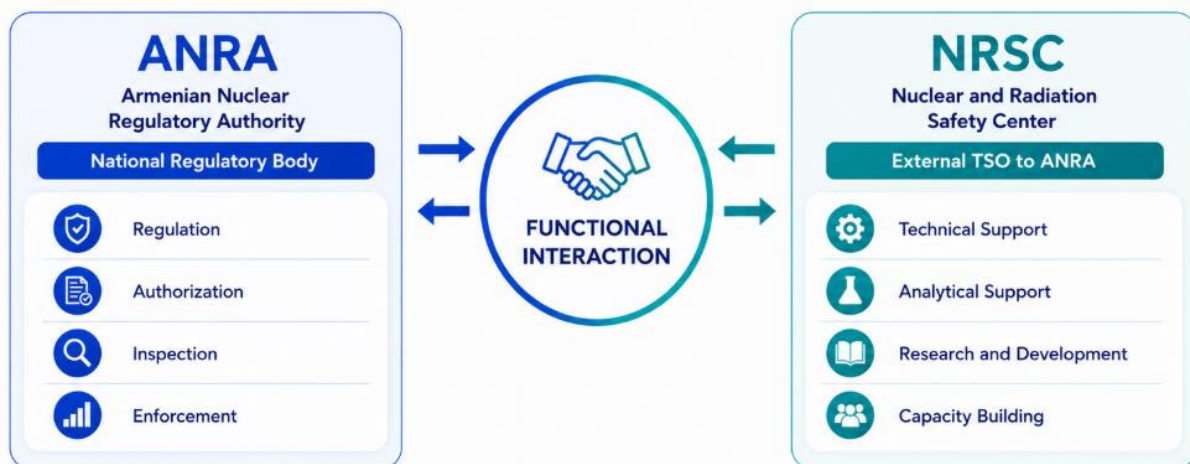


Figure 2. Functional interface between ANRA and NRSC

This model reflects the principle that the Regulatory Body retains full responsibility for regulatory decisions, while technical and scientific support may be obtained from competent expert organizations. Within this framework, ANRA defines regulatory needs, establishes the scope of review and assessment activities, determines regulatory expectations and makes final regulatory decisions. NRSC provides independent technical and scientific analyses, reviews, evaluations and expert conclusions supporting evidence-based regulatory decision-making.

The Armenian regulatory support model is therefore based on clear functional separation between regulatory authority and technical support functions. ANRA remains responsible for authorization, regulatory review and assessment, inspection, enforcement and other regulatory decisions. NRSC does not replace ANRA's regulatory authority, but provides the technical basis, analytical support and scientific justification necessary for ANRA to perform its regulatory functions effectively.

In practical terms, ANRA identifies the need for technical support and defines the objectives and scope of the requested review. NRSC performs technical assessments, applies analytical methods and computational tools, reviews documentation, prepares expert conclusions and provides recommendations. ANRA considers these technical inputs within its regulatory decision-making process while retaining full responsibility for the final decision.

The existence of a competent and sustainable TSO is particularly important for Armenia because the national nuclear and radiation safety programme is technically complex and continues to evolve. Current and future regulatory needs are connected with long-term operation of the Armenian NPP, implementation of safety enhancement programmes, radioactive waste management, radiation safety infrastructure, emergency preparedness

and response, and consideration of future nuclear power development options, including advanced reactors and SMRs.

Within this context, the Armenian TSO model is not only an operational support arrangement, but also a strategic element of the national regulatory infrastructure. It helps preserve national technical expertise, maintain analytical capabilities, support independent technical review and ensure continuity of scientific and technical support in areas where specialized national expertise is limited. The ANRA-NRSC interface also strengthens technical robustness of regulatory decisions and contributes to the long-term sustainability of national regulatory support functions.

The application of the IAEA TOSCA methodology in Armenia was directly connected with this institutional context. TOSCA was used to assess whether existing technical support arrangements, organizational capabilities, competence management systems and long-term sustainability mechanisms are adequate to support ANRA in addressing current and future regulatory responsibilities.

The TOSCA assessment considered the ANRA-NRSC interface from several complementary perspectives. NRSC assessed its internal capabilities, technical functions, competence base and sustainability as a TSO. ANRA assessed the adequacy, quality, timeliness and usefulness of the technical support received from NRSC. The IAEA expert team provided an independent international perspective, including observations related to sustainability, competence development, strategic planning, management arrangements and preparedness for future programme needs.

This combination of perspectives helped ensure that the assessment did not remain limited to internal organizational self-evaluation. It also examined how effectively the Armenian TSO model supports the Regulatory Body and how the ANRA-NRSC interface can continue to meet future national needs. In this way, TOSCA supported the review of the Armenian regulatory support infrastructure as an integrated system in which regulatory authority and technical expertise are clearly separated, but functionally connected.

3.2 ANRA

ANRA is the national Regulatory Body responsible for state regulation in the field of peaceful use of atomic energy and radiation safety in the Republic of Armenia. Established by Government Decree in 1993, ANRA is the sole national authority responsible for regulation of atomic energy utilization and radiation safety (Figure 3).

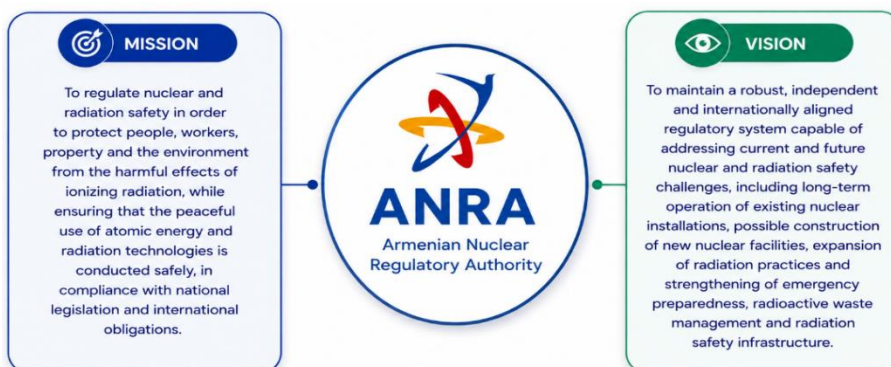


Figure 3. ANRA mission and vision

ANRA's mission is to protect people, workers, property and the environment from the harmful effects of ionizing radiation while ensuring that the peaceful use of atomic energy and radiation technologies is conducted safely and in compliance with national legislation and international obligations (see Figure 3).

To fulfil this mission, ANRA establishes and implements the national regulatory framework covering licensing and authorization, regulatory review and assessment, inspection and enforcement, development and implementation of regulatory requirements, radiation safety regulation, nuclear safety and security oversight, emergency preparedness and response, regulatory control of nuclear and radiation practices, and cooperation with national and international organizations.

ANRA retains full responsibility for regulatory decisions and exercises its authority independently. Its regulatory approach is based on graded, risk-informed and evidence-based decision-making, supported where necessary by objective technical and scientific expertise. This is particularly important in technically complex areas such as nuclear safety assessment, radiation protection, radioactive waste management, emergency preparedness, long-term operation and future nuclear programme development.

To support these activities, ANRA relies on technical and scientific expertise provided by NRSC as the external TSO. A clear functional separation is maintained between ANRA and NRSC. ANRA defines regulatory needs, establishes the scope of review activities and makes final regulatory decisions, while NRSC provides independent technical and scientific support. This arrangement preserves regulatory independence and objectivity while enabling ANRA to utilize specialized national expertise.

ANRA's vision is to maintain a robust, independent and internationally aligned regulatory system capable of addressing current and future nuclear and radiation safety challenges, including long-term operation of existing facilities, potential new nuclear projects, expansion of radiation practices and continued strengthening of emergency preparedness, radioactive waste management and radiation safety infrastructure (see Figure 3).

During the TOSCA implementation, ANRA participated from the perspective of the Regulatory Body receiving technical support. This perspective was important because the effectiveness of a TSO is reflected not only in its internal capabilities, but also in the quality, relevance and usefulness of the support provided to the Regulatory Body.

Together, ANRA and NRSC form a coordinated national regulatory support framework in which regulatory authority and technical expertise remain clearly separated while functionally integrated. This model supports long-term regulatory effectiveness, credibility and sustainability and is consistent with IAEA safety standards and international good practice.

3.3 NRSC as external TSO

NRSC was established by the Government of the Republic of Armenia in 2001 as a scientific and research organization providing technical support in the field of nuclear and radiation safety. It functions as an independent external TSO to ANRA under formal contractual arrangements.

NRSC provides objective, technically justified and scientifically supported analyses and evaluations, while remaining separate from regulatory decision-making. Its role is to

provide the technical basis, scientific justification and expert input necessary for ANRA to perform its regulatory functions effectively.

The scope of NRSC activities is linked to the core regulatory functions of ANRA and includes safety analyses and technical evaluations, deterministic and probabilistic safety assessments, independent technical reviews, support to development and review of regulatory documents, emergency preparedness and response support, radiation measurements and monitoring, research and development, application of analytical tools and computational methods, support to technical investigations, competence development and knowledge management.

NRSC operates as a project-oriented scientific and technical organization. Its capabilities are maintained and developed through annual contractual tasks with ANRA, national and international projects, research activities, technical cooperation and participation in expert networks. This project-based model enables NRSC to respond to current regulatory needs, while also requiring systematic attention to workload planning, continuity of expertise, knowledge transfer, development of new technical areas and sustainability of analytical capabilities.



Figure 4. NRSC mission and vision

NRSC's mission is to provide objective, reliable and high-quality technical and scientific support to ANRA and to continuously maintain and develop the expertise required for effective regulatory decision-making. This mission includes both the provision of timely technical support for current regulatory tasks and the continuous development of capabilities needed for future national nuclear and radiation safety challenges (Figure 4).

NRSC's vision is to remain a trusted, competent and preferred provider of technical and scientific support in the field of nuclear and radiation safety, primarily for ANRA and other relevant national stakeholders, while strengthening its recognition at regional and international levels (Figure 4). This vision reflects the role of NRSC as the main national expert organization in nuclear and radiation safety and as a key institution supporting the sustainability of Armenia's regulatory infrastructure.

In line with its mission and vision, NRSC's strategic development is focused on three interconnected targets (Figure 5):

- further enhancement of nuclear and radiation safety;
- maintenance and development of scientific and technical competence; and
- ensuring sustainability and organizational effectiveness.

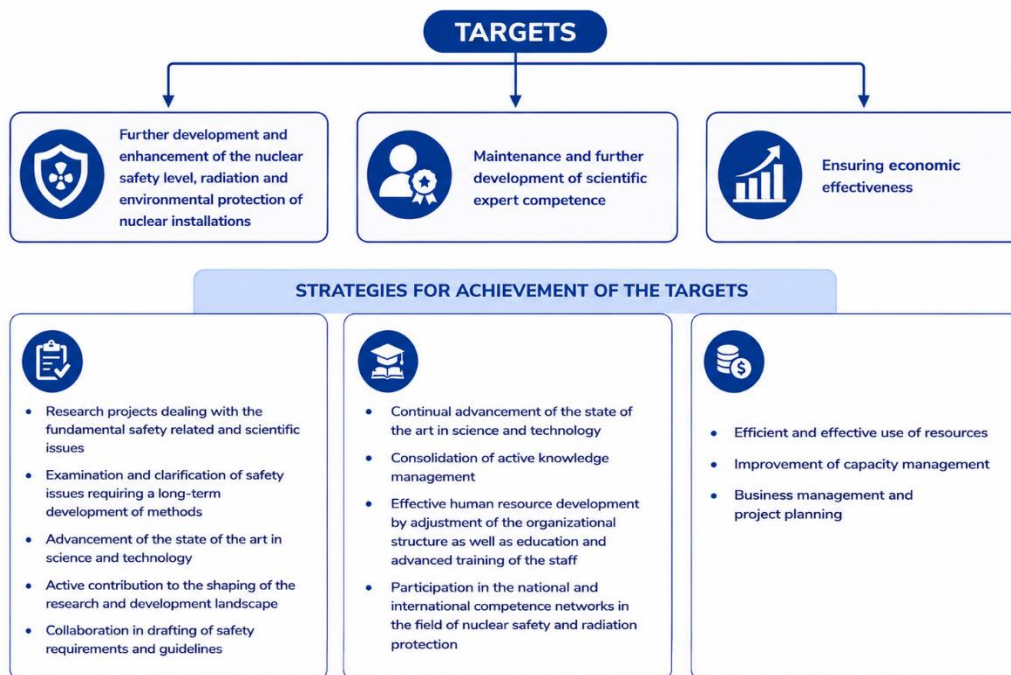


Figure 5. Strategic targets supporting sustainable development of NRSC

The first target reflects NRSC’s contribution to protection of people, society and the environment through safety assessment, technical review, radiation safety support, emergency preparedness and development of technical bases for regulatory decisions.

The second target reflects the need to preserve, renew and expand specialized expertise through competence development, mentoring, knowledge transfer, research and development, analytical tool development and participation in international technical cooperation.

The third target reflects the need to ensure that NRSC remains organizationally stable, technically capable and sustainable through effective management arrangements, quality assurance of technical outputs, project and resource management, strategic planning and long-term cooperation with ANRA and international partners.

The mission, vision and target system of NRSC formed one of the important foundations for the development of TOSCA Action Plans and strategic capability goals. During the assessment, findings were not considered only as isolated weaknesses or improvement needs. They were interpreted in relation to NRSC’s mission, long-term strategic targets and future role as a TSO. This helped ensure that the Action Plans were not limited to corrective actions, but also supported broader organizational development and capability sustainability.

For example, findings related to human resources, competence gaps and staff turnover were linked to the strategic target on maintaining and developing scientific and technical competence. Findings related to research and development were linked to both competence development and technical support sustainability. Findings related to management system improvement were linked to organizational effectiveness and quality of technical outputs. Findings related to the National Radiation Laboratory development, emergency preparedness and analytical tools were linked to enhancement of nuclear and radiation safety support capabilities.

This approach allowed the Action Planning process to become more strategic and forward-looking. Instead of simply responding to individual findings, NRSC used the TOSCA results to identify development directions supporting its mission, vision and long-term role as a TSO.

These strategic directions were relevant for the TOSCA assessment, as the assessment considered not only NRSC's current technical support functions, but also its ability to preserve expertise, develop new capabilities, transfer knowledge and remain prepared for future nuclear and radiation safety challenges. In this respect, TOSCA supported the review of NRSC not only as an operating TSO, but also as a strategic national capability requiring continuous development and long-term sustainability.

4. Overview of the IAEA TOSCA methodology

4.1 General overview of the TOSCA methodology

The IAEA TOSCA (Technical and Scientific Support Organization Self-Capability Assessment) methodology is a structured and internationally recognized framework developed to support the assessment and strengthening of TSOs and related organizations providing technical and scientific support to Regulatory Bodies in the field of nuclear and radiation safety. The methodology was developed by the IAEA based primarily on the principles and concepts established in IAEA TECDOC-1835, “Technical and Scientific Support Organizations Providing Support to Regulatory Functions” (see Figure 6).



Technical and Scientific Support Organizations Self Capability Assessment (TOSCA)

A new innovative web-based tool for the self-assessment of capabilities of Technical and Scientific Support Organizations (TSOs) supporting national regulatory bodies

What is the TSOF ?

The Technical Support Organizations Forum (TSOF), established in 2010 by the IAEA, promotes collaboration among TSOs and other organizations interested in technical and scientific issues related to nuclear safety and security.

TSOF is open to TSOs and expert groups nominated by IAEA Member States. Representatives of the European Commission, the Organization for Economic Co-operation and Development Nuclear Energy Agency (OECD NEA) and regional TSO networks participate as observers. A TSOF Steering Committee facilitates and oversees the implementation of the forum's programme.

What does TSO Forum offer?

This forum offers a platform to develop common approaches to build and maintain a high level of safety in line with the IAEA Safety Standards (www.iaea.org/resources/safety-standards). It is an initiative to help Member States develop and strengthen their technical and scientific capabilities, based on an IAEA TECDOC 1835 developed with the support of the Forum.

Regulatory functions require support by scientific and technical expertise.

The support provided by the TSOs can facilitate development and/or provision of regulations and guides, notification and authorization, licensing procedures, regulatory review and assessment, regulatory inspection, enforcement, emergency preparedness and response and communication as well as opportunities to engage in consultation with interested parties.

There is no 'one size fits all' standard model for a technical and scientific support organization.

In this context, TECDOC-1835 defines core notions and values, to help countries to evaluate their current and future needs for technical and scientific support to cover the safety and security of the whole life cycle of their national nuclear facilities. This publication also provides some illustrative national examples on how to develop and enhance TSO capabilities. It also highlights that the organization and



Figure 6. TOSCA leaflet (IAEA)

The methodology combines organizational assessment, technical capability evaluation, sustainability analysis and Action Planning into one integrated process. Its flexibility allows application in organizations with different structures, sizes and maturity levels, while maintaining consistency of assessment logic and implementation principles.

The methodology supports evaluation of organizational effectiveness, technical support capabilities, sustainability of expertise, management arrangements and long-term capability development of organizations performing technical and scientific support functions. It also provides a structured basis for identifying strengths, weaknesses, capability gaps and improvement priorities, while supporting preparation of strategic and implementation-oriented Action Plans.

TOSCA is intended to support continuous improvement of TSOs and strengthening of national nuclear and radiation safety regulatory infrastructures. In practice, the methodology helps organizations evaluate whether existing technical support arrangements remain adequate, sustainable and capable of supporting current and future regulatory responsibilities.

The methodology is implemented through a structured and evidence-based assessment process involving:

- self-assessment questionnaires;
- document reviews;
- SWOT analyses;
- stakeholder discussions;
- expert evaluation;
- development of Action Plans for continuous improvement.

An important characteristic of TOSCA is that it evaluates not only current organizational performance, but also long-term sustainability of technical expertise, competence development, knowledge management, organizational resilience and preparedness for future regulatory challenges.

4.2 Objectives and expected outcomes of the methodology

The overall objective of the TOSCA methodology is to support organizations in evaluating and strengthening their capability to provide effective, objective and sustainable technical and scientific support to Regulatory Bodies.

More specifically, the methodology supports organizations in (Figure 7):



Figure 7. Key areas supported by the TOSCA methodology

Expected outcomes of TOSCA implementation include (Figure 8):



Figure 8. Expected outcomes of TOSCA implementation

4.3 Key principles of the TOSCA methodology

The TOSCA methodology is based on several interconnected methodological principles intended to ensure that the assessment process is systematic, objective, traceable and implementation-oriented (Figure 9).



Figure 9. Key principles of the TOSCA methodology

A central principle is the use of a structured assessment process. The methodology follows a defined sequence of activities, beginning with preparation and continuing through self-assessment, analysis, review, Action Planning, implementation and follow-up. This structured approach establishes clear links between identified findings, recommendations and subsequent improvement actions.

Another important principle is evidence-based assessment. Assessment results are derived from objective information, including documented evidence, technical outputs, organizational records, interviews and discussions. The use of verifiable evidence enhances the credibility, consistency and transparency of the assessment process and supports well-justified conclusions.

The methodology also emphasizes broad stakeholder involvement. Participation of organizational management, technical experts, Regulatory Bodies and international experts ensures that different perspectives are considered during the assessment. This contributes to a more balanced evaluation and strengthens the relevance and acceptance of the assessment results.

4.4 TOSCA cycle

The TOSCA methodology is implemented through a structured cycle that supports assessment, validation, Action Planning, implementation and periodic reassessment of TSO capabilities. The cycle is organized in a manner broadly consistent with the logic of the Plan-Do-Check-Act (PDCA) continual improvement approach, where preparation and planning are followed by assessment, review and validation, implementation of improvement actions and subsequent reassessment (Figure 10).

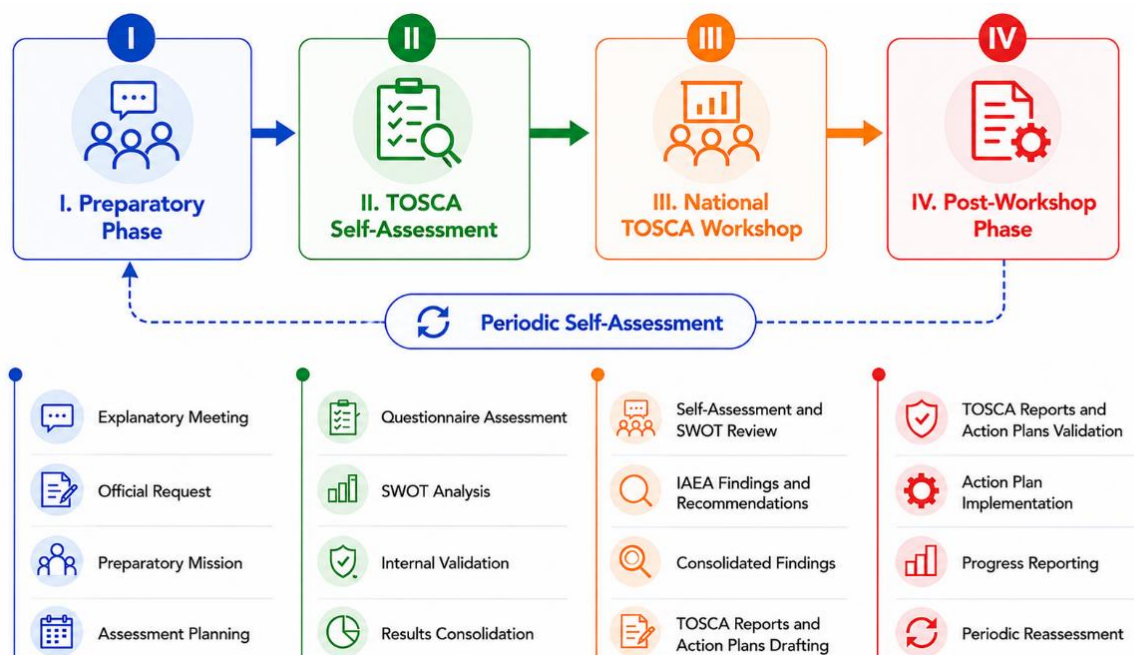


Figure 10. TOSCA cycle

In this context, the Preparatory Phase corresponds to the planning stage of the process. It establishes the basis for the assessment through explanatory meetings, official request, preparatory mission, definition of scope, agreement on implementation arrangements and assessment planning.

The TOSCA Self-Assessment Phase corresponds to the implementation of the assessment activities. During this phase, participating organizations complete the questionnaires, perform ratings, collect supporting evidence, conduct SWOT analyses, validate results internally and consolidate assessment outputs.

The National TOSCA Workshop represents the review and validation stage of the cycle. It provides a structured forum for review of self-assessment results and SWOT analyses, discussion of findings, independent IAEA review and consolidation of recommendations and development priorities.

The Post-Workshop Phase corresponds to the action and improvement stage. It includes preparation and validation of TOSCA reports and Action Plans, implementation of improvement measures, monitoring of progress and follow-up activities. Periodic self-assessment and possible reassessment close the cycle and support continuous improvement of TSO capabilities.

The TOSCA cycle therefore provides a structured framework for transforming assessment results into practical improvement measures. By following a PDCA-like logic, the methodology supports not only evaluation of current capabilities, but also long-term development, monitoring and continual enhancement of technical and scientific support functions.

4.5 TOSCA assessment domains (pillars)

The TOSCA methodology evaluates organizational and technical capabilities across several functional and cross-cutting areas relevant to TSO performance and sustainability.

The assessment is structured through eight assessment pillars (Figure 11):



Figure 11. TOSCA assessment domains (pillars)

For methodological purposes, the eight pillars may be grouped into two main categories:

- Management pillars - Pillars 1-2;
- Technical pillars - Pillars 3-8.

Pillars 1 and 2 address the management and organizational foundation of the TSO. They cover the role, characteristics and management of the organization, as well as capacity building, outreach, competence development, human resource arrangements, knowledge management and sustainability of expertise.

Pillars 3-8 address the technical support functions of the TSO. They cover support to safety assessment and inspection, development of regulatory documents, radiation protection and safety of radioactive sources, assessment of operating experience, emergency preparedness and response, and research and development.

Together, these pillars provide an integrated framework for assessing both the management basis and the technical capabilities of a TSO. This structure ensures that technical performance is evaluated together with the organizational arrangements, competence, resources and sustainability mechanisms necessary for effective and reliable support to the Regulatory Body.

4.6 TOSCA workshops

TOSCA implementation is normally initiated by a formal request from the IAEA Member State to the IAEA. Following this request, the IAEA conducts a Preparatory Mission in the country to introduce the methodology, explain the assessment process, identify participating organizations and agree on the general scope, roles and implementation arrangements (Figure 12).



Figure 12. TOSCA workshops

The Preparatory Mission usually supports:

- familiarization with the TOSCA methodology and tool;
- clarification of assessment objectives and expected outputs;
- identification of participating organizations and responsible persons;
- agreement on the assessment scope, schedule and coordination arrangements.

After the Preparatory Mission, participating organizations conduct self-assessment activities. This stage includes answering assessment questions, assigning ratings,

providing feedback and justification, reviewing supporting documentation and preparing SWOT analyses based on the assessment results.

The National TOSCA Workshop is then organized as the main platform for discussion, review and validation of assessment outputs (Figure 12). During the workshop, participating organizations present their self-assessment results and SWOT analyses, discuss identified strengths, weaknesses, opportunities and threats, and clarify capability gaps and development needs.

The workshop also provides the basis for the IAEA expert team to review the results, discuss them with national participants and formulate findings and recommendations. These findings and recommendations provide an independent expert perspective and help identify cross-cutting issues, strategic development needs and areas requiring further improvement.

Following the National TOSCA Workshop, the country continues work on preparation of TOSCA reports and Action Plans. At this stage, self-assessment results, SWOT analyses, workshop discussions and IAEA findings are consolidated into Organization Reports, the National TOSCA Report and implementation-oriented Action Plans.

Overall, TOSCA workshops support communication between participating organizations and the IAEA expert team, validation of assessment results, harmonization of conclusions and transformation of assessment outputs into practical improvement priorities and long-term capability development actions.

4.7 Participants and roles in the TOSCA self-assessment

The TOSCA self-assessment process requires participation of multiple organizational representatives with clearly defined responsibilities and coordination arrangements.

The self-assessment process involves three main categories of participants:

- 1) Organization Responsible (OR);
- 2) Focal Points of Pillars 1-8 (FPP1-8);
- 3) Organization Assessment Respondents (OAR).

Each participant category performs distinct but interconnected functions within the overall assessment structure. The responsibilities and functions of participants are provided in the Figure 13.

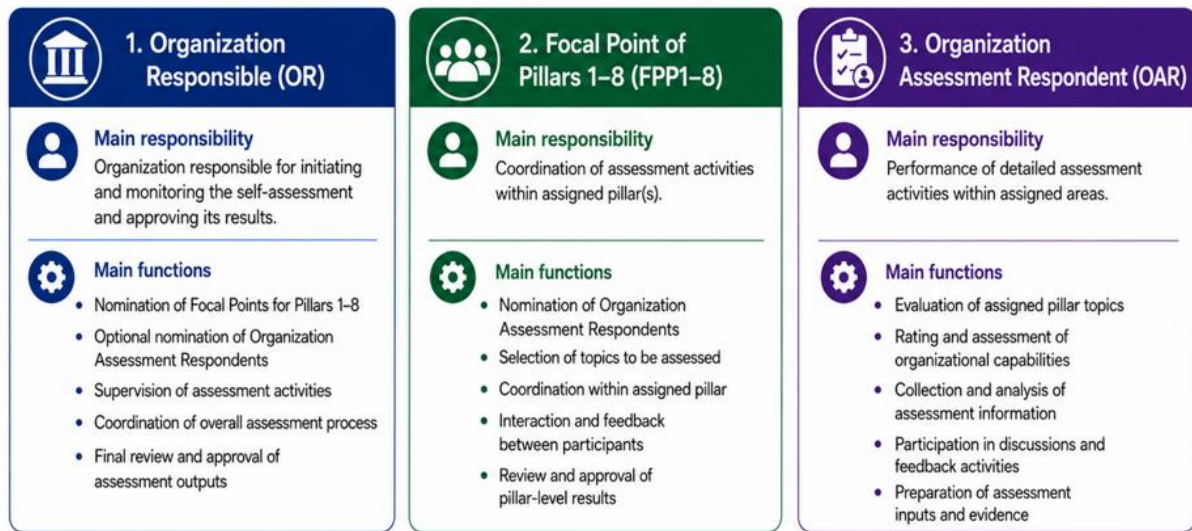


Figure 13. Participants and roles in TOSCA self-assessment

4.8 Approach to assessment

The TOSCA methodology provides considerable flexibility in defining the assessment approach, allowing the assessment to be tailored to the specific objectives, organizational needs, available resources and expected outcomes of the participating organization. This flexibility enables application of the methodology to organizations with different levels of maturity, responsibilities and technical capabilities, while ensuring that assessment results remain practical, objective and useful for decision-making.

The assessment approach may be defined through three complementary dimensions: the scope of assessment, the depth of assessment and the assessment orientation (Figure 14).

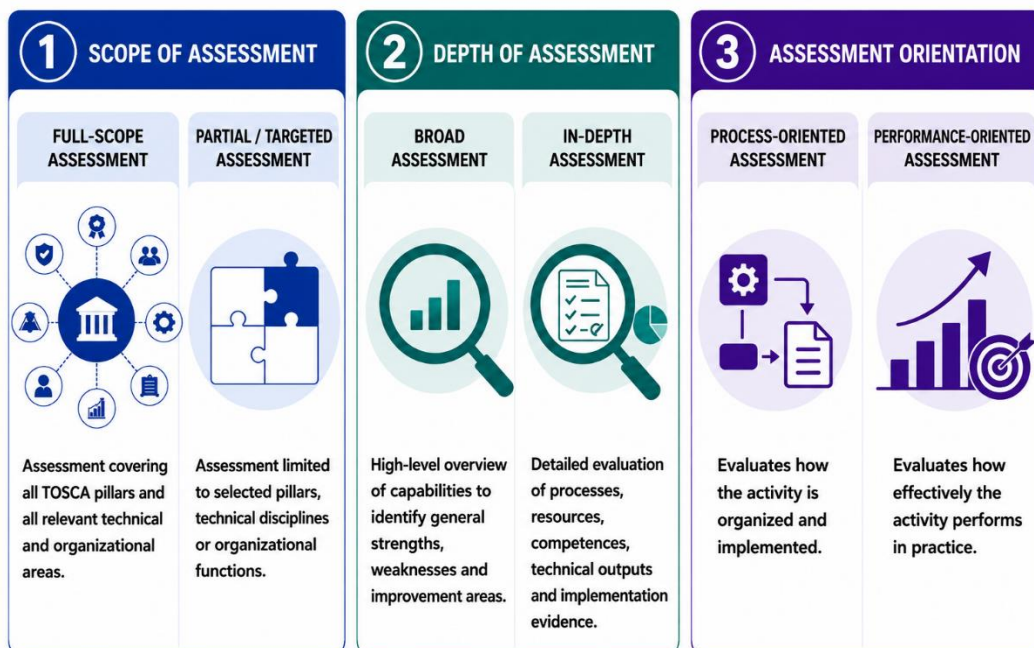


Figure 14. TOSCA assessment approaches

Scope of assessment determines the organizational boundaries and areas included in the assessment. A full-scope assessment covers all TOSCA pillars and all relevant organizational, technical and management areas, providing a comprehensive evaluation of TSO capabilities. Alternatively, a partial or targeted assessment may be performed when the objective is to evaluate specific technical disciplines, organizational functions, programmes or capability areas. This approach may be particularly useful when resources are limited or when an organization wishes to focus on a specific development priority.

Depth of assessment determines the level of detail applied during the evaluation. A broad assessment provides a high-level overview of organizational capabilities and is typically used to identify general strengths, weaknesses, opportunities and improvement areas. An in-depth assessment involves a more detailed examination of processes, organizational arrangements, resources, competencies, technical outputs and supporting evidence. This approach provides a more comprehensive understanding of performance and capability maturity and may be applied to selected pillars or organizational functions requiring detailed analysis.

Assessment orientation defines the perspective from which activities are evaluated. A process-oriented assessment focuses on how activities are organized, managed and implemented. It examines the existence and effectiveness of organizational arrangements, procedures, interfaces and management controls. A performance-oriented assessment focuses on the results achieved by those activities and evaluates their effectiveness, quality, sustainability and contribution to organizational objectives. In practice, both perspectives are complementary and are often applied together to provide a balanced assessment of organizational capability.

The ability to combine different assessment scopes, depths and orientations represents one of the strengths of the TOSCA methodology. It enables organizations to adapt the assessment to their specific circumstances while maintaining a structured and consistent evaluation framework. This flexibility supports both comprehensive organizational assessments and focused evaluations of particular capability areas, thereby enhancing the usefulness of assessment results and subsequent Action Planning activities.

4.8.1 Self-assessment process

The self-assessment represents the core analytical activity of the TOSCA methodology. Following completion of the preparatory activities and configuration of the assessment parameters, participating organizations conduct a structured evaluation of their technical and organizational capabilities using the TOSCA online assessment tool.

The self-assessment is performed at the level of individual topics within each TOSCA pillar and is based on a standardized questionnaire structure. This approach ensures consistency of evaluation across different technical and organizational areas while allowing organizations to reflect their specific circumstances, priorities and development needs.

The self-assessment process generally includes the following activities (Figure 15):

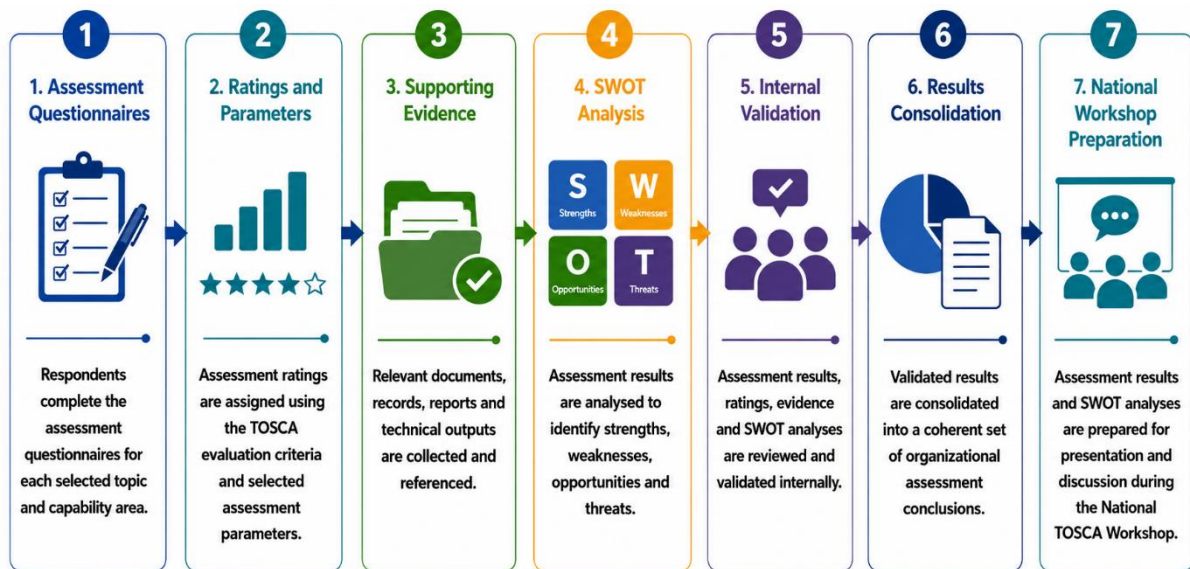


Figure 15. Main activities of the TOSCA self-assessment process

For each assessment topic, the methodology applies a generic set of five assessment questions. The first question evaluates the process dimension of the activity, while the remaining four questions evaluate its performance dimension (Figure 16).

Safety assessment review and inspection are performed to support the regulatory body in determining whether facilities and activities comply with regulatory obligations and conditions.

Topic No.	Topic	Development Step	Nat. Priority	Guidance	TECDOC 1835	Rating completed?	FIP approved?
3	Support to Safety Review and Assessment: (Broad analysis)	① ② ③ ④	L M H	👁	4.1	✓	✓
Nr.	Process-oriented question				Rating	Feedback (optional)	Justification (optional) ⓘ
1	Please evaluate your existing or under development process for its adequacy in the context of TSO functions in this area .				★★★★★	📝	📄
Nr.	Performance-oriented question				Rating	Feedback (optional)	Justification (optional) ⓘ
2	Please rate resource availability with respect to the needs resulting from the TSO functions in this area, taking into account funds, experts, training opportunities, tools, equipment, etc.				★★★★☆	📝	📄
3	Please rate how experts involved in the activities in this area have and maintain state-of-the-art competence, are aware of the nature of the TSO work they have to perform and their corresponding accountability.				★★★★★	📝	📄
4	Please evaluate the satisfaction of the Regulatory Body and/or other stakeholders to which technical support is provided by the TSO in this area, for example with respect to trust, cost/satisfaction ratio, delays and quality assurance.				★★★★★	📝	📄
5	Please rate the involvement of your organization and of your experts in this area, with respect to outreach, networking and cooperation at national, regional and international levels.				★★★★☆	📝	📄

Figure 16. Generic structure of TOSCA assessment questions

The process-oriented question focuses on the extent to which the activity is formally established, organized and managed. It considers the existence and adequacy of organizational arrangements, policies, procedures, management processes and other mechanisms necessary to support implementation of the activity.

The performance-oriented questions evaluate how effectively the activity functions in practice. These questions examine several key performance aspects, including availability of resources, competence and involvement of personnel, satisfaction of the Regulatory Body and other stakeholders receiving support, and participation of the organization and its experts in national and international cooperation, networking and outreach activities.

Together, the process and performance questions provide a balanced assessment of both the organizational framework and the effectiveness of implementation.

Assessment respondents assign ratings to each question using the TOSCA rating methodology (see Section 4.9). In addition to assigning ratings, respondents select the

applicable Development Step and National Priority (see Subsections 4.9.1 and 4.9.2) associated with the assessed topic and may provide supporting comments, observations and justification for the assigned ratings.

Assessment conclusions should be supported by objective evidence whenever possible. Relevant organizational documents, management system records, procedures, reports, technical outputs, training records and other supporting materials may be referenced or attached within the assessment tool. The Justification function provides a dedicated mechanism for recording supporting evidence and the rationale for assigned ratings (see Subsection 4.9.5). This evidence-based approach improves transparency, consistency and traceability of assessment results and facilitates subsequent review, validation and consolidation activities.

The self-assessment process is intended to be collaborative. Assessment respondents are encouraged to consult with colleagues, subject-matter experts and organizational management in order to ensure that ratings accurately reflect the actual status of the assessed activity. The Feedback function supports this exchange by allowing observations, explanations and practical comments to be recorded during the assessment process (see Subsection 4.9.4). Such discussions help establish a common understanding of organizational strengths, weaknesses and development needs and contribute to consistency of assessment results across the organization.

Upon completion of the questionnaires, the assessment results are reviewed and consolidated at organizational level. The consolidated results form the basis for development of SWOT analyses, preparation of Organization Reports and discussion of assessment results during the National TOSCA Workshop (see Section 4.6, Subsections 4.11-4.12).

TOSCA assessment components and supporting mechanisms are described in details in Section 4.9 of this Case Study.

4.9 Assessment components and supporting mechanisms

The TOSCA methodology applies a structured assessment logic based on three core assessment components (Figure 17):

- 1) National Priority;
- 2) Development Step;
- 3) Rating.

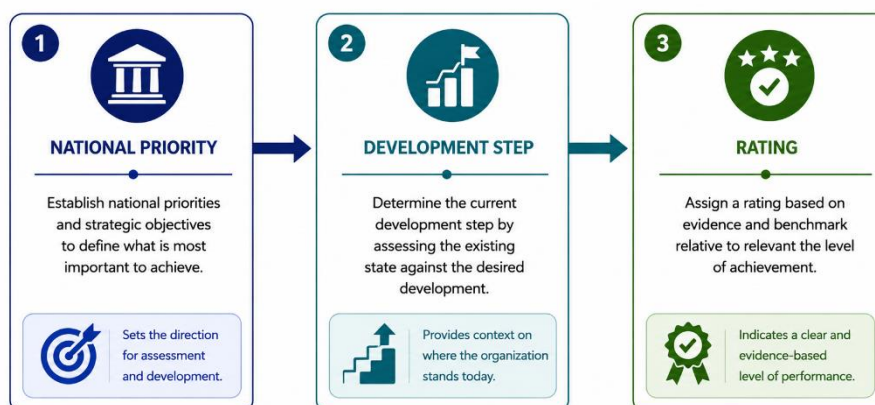


Figure 17. TOSCA core assessment components

These components form the analytical basis for evaluating organizational capabilities, technical performance and long-term sustainability.

The assessment process is further supported by two complementary mechanisms (Figure 18):

- 1) Feedback;
- 2) Justification.

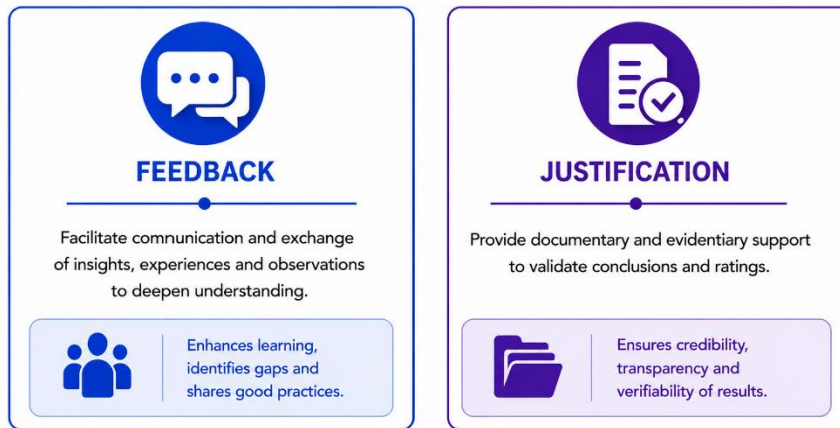


Figure 18. TOSCA supplementary assessment components

Feedback and Justification support the assessment process by facilitating communication, documenting explanations, contextual observations and supporting evidence, while strengthening transparency and traceability of conclusions. Together with the core assessment components, these mechanisms ensure that assessment results are systematically generated, clearly explained, evidence-based and practically useful for Action Planning. They also provide a documented basis for assigned ratings and conclusions.

4.9.1 National Priority

The National Priority component determines the relative strategic importance of each assessed topic within the national nuclear and radiation safety framework. It helps identify which areas require immediate attention, accelerated development or long-term strengthening (Figure 19).

Priority levels are used to classify assessed topics according to their significance for regulatory effectiveness, safety relevance, urgency and expected impact on national capability development. These levels support a structured distinction between high-priority areas requiring prompt action, medium-priority areas requiring planned improvement, and low-priority areas suitable for gradual or long-term enhancement.



Figure 19. National Priority assessment approach

The National Priority component also supports prioritization of resources, phased planning of improvement actions and identification of capability areas essential for long-term regulatory effectiveness.

4.9.2 Development Step

The Development Step component is used to characterize the stage of development of the TSO capability being assessed. It provides context for evaluating technical and organizational capabilities in relation to national needs, available resources, institutional arrangements and expected progression of the TSO framework.

The TOSCA methodology recognizes that TSOs may operate under different national circumstances and may be at different stages of development. Therefore, assessment results should be interpreted in relation to the current development stage of the organization and the expected path towards sustainable technical and scientific support.

The methodology defines four Development Steps (Figure 20):



Figure 20. Development Step maturity levels within the TOSCA assessment framework

The Development Steps can also be viewed as a progression of national capability and organizational maturity. As shown in Figure 21, they are linked to key milestones in TSO establishment and operation, including recognition of the need for a national TSO, decision to establish the TSO, start of implementation, structured operation and reliable long-term performance.

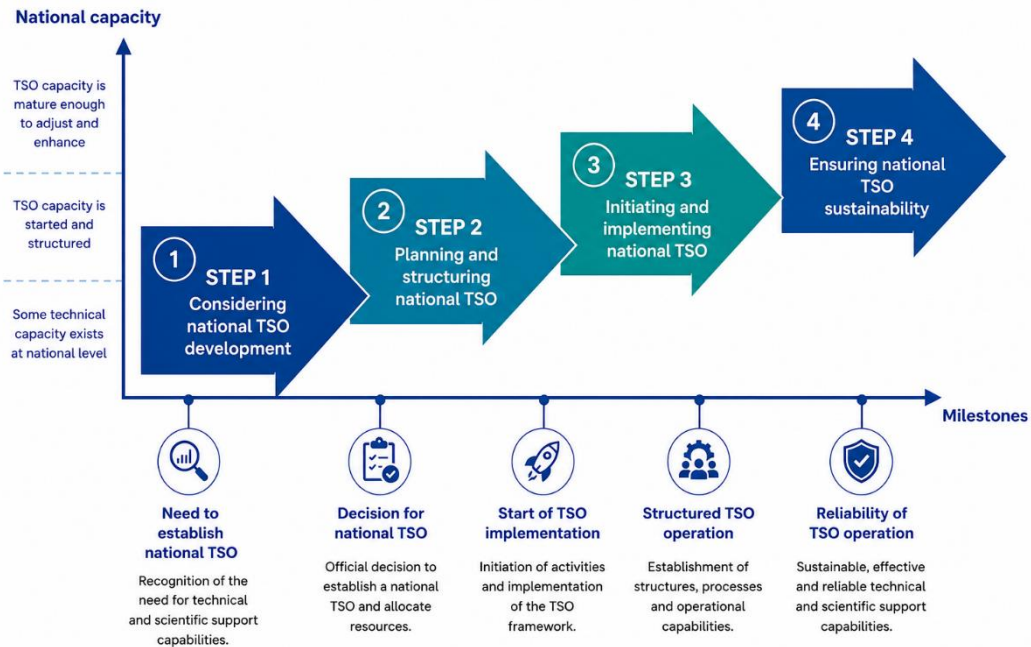


Figure 21. Relationship between TSO Development Steps, national capacity and organizational milestones

The Development Step component helps establish realistic expectations, identify capability gaps and define phased improvement measures. It supports prioritization of resources and preparation of practical Action Plans aligned with achievable short-, medium- and long-term development objectives.

4.9.3 Rating

The Rating component evaluates the level of implementation, maturity and effectiveness of assessed organizational and technical areas. It provides a structured measure of how far a capability has been developed and how effectively it supports the expected function (Figure 22).

The rating logic is based on predefined assessment levels that reflect the degree of implementation, availability of evidence, consistency of application and effectiveness in practice. Ratings help distinguish between areas that are not yet established, partially implemented, generally functional or fully effective and sustainable.

This component supports objective comparison across assessed topics, identification of strengths and weaknesses, prioritization of improvement actions and preparation of evidence-based conclusions.

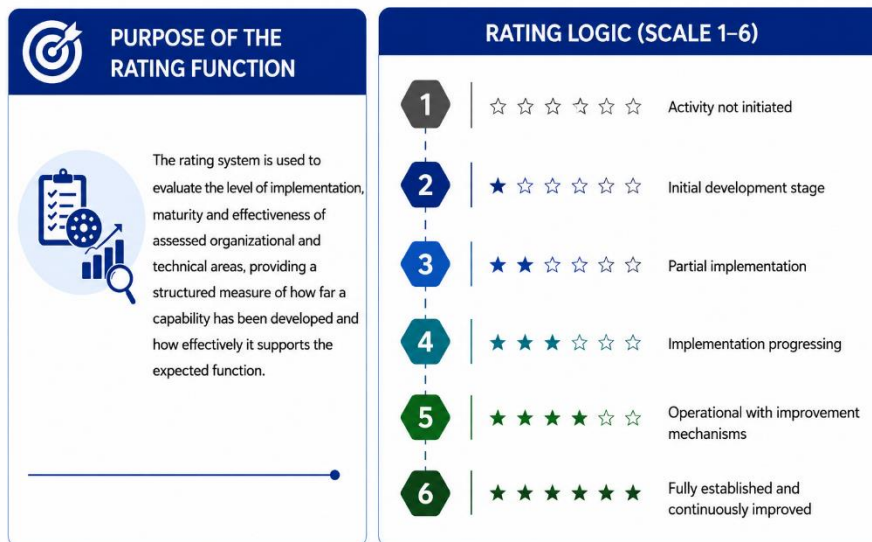


Figure 22. Rating logic used in the TOSCA assessment framework

4.9.3.1 Benchmark levels

The rating process is based on comparison between the actual organizational situation and a predefined Benchmark level. Ratings should be supported by documented evidence, practical examples, technical outputs, organizational records and expert discussions.

The Benchmark level serves as the main reference point for evaluating organizational capabilities. It is not a fixed or universal value, but is defined through the combination of two parameters:

- National Priority, which defines the strategic importance of the assessed topic within the national nuclear and radiation safety framework;
- Development Step, which defines the expected level of maturity and capability development for the organization.

The relationship between these parameters can be expressed as (Figure 23):

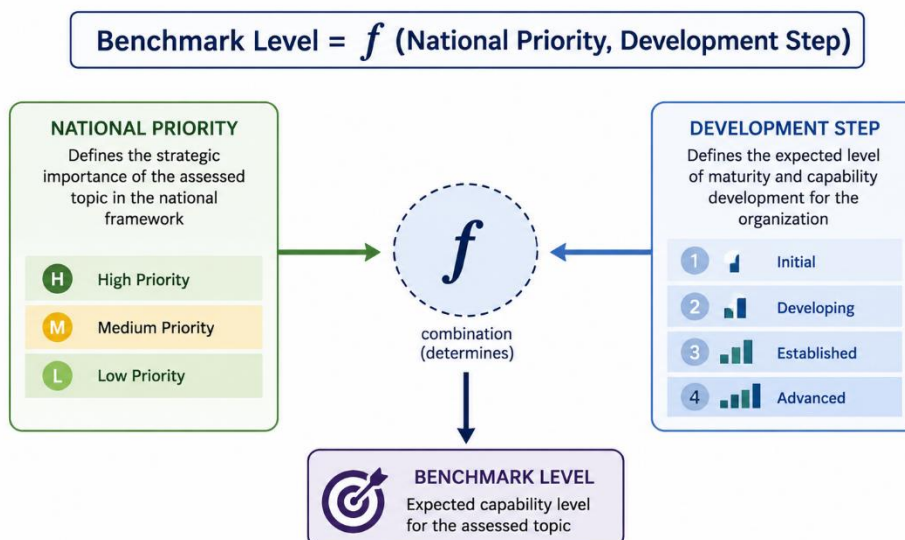


Figure 23. Benchmark level formation in the TOSCA methodology

National Priorities reflect national objectives, regulatory needs and long-term strategic goals, while Development Steps reflect the organization's stage of capability development. Consequently, Benchmark Levels may differ between organizations and assessment topics, ensuring that expectations remain aligned with both national needs and organizational context.

The assessment compares the actual situation with the established Benchmark Level to determine the degree of achievement and identify gaps requiring improvement.

To provide a balanced evaluation, the TOSCA methodology considers two complementary rating dimensions (Figure 24):

- Process Rating;
- Performance Rating.

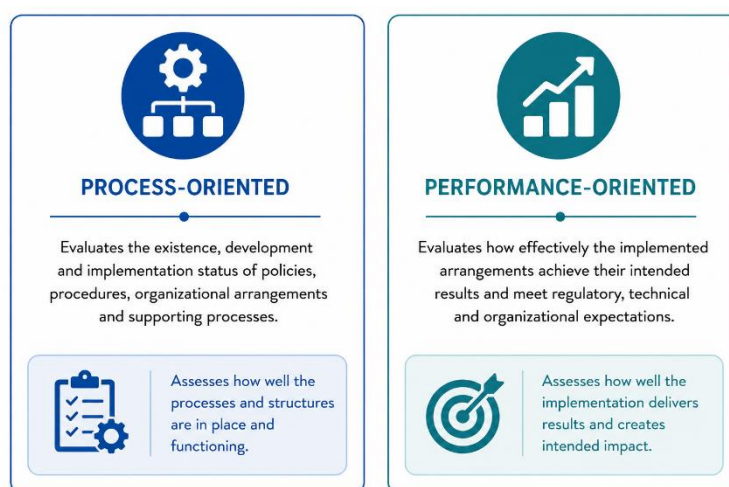


Figure 24. Process and Performance Rating dimensions

The Process Rating evaluates the existence, adequacy and implementation of policies, procedures, organizational arrangements and supporting management processes. The Performance Rating evaluates the effectiveness of these arrangements in achieving intended outcomes and meeting regulatory, technical and organizational expectations.

Together, these dimensions provide an assessment of both the mechanisms established by the organization and the results achieved through their implementation.

4.9.4 Feedback as a supporting mechanism

Feedback is a qualitative and interactive supporting mechanism within the TOSCA assessment process. It does not replace the formal assessment components, but supports their application through communication, exchange of perspectives and clarification of assessment results (Figure 25).

The TOSCA tool defines Feedback as a communication and documentation function between responsible persons assigned to pillars and topics during and after the rating process. It allows participants to record observations, explanations and practical insights related to assessed topics and rating results.



Figure 25. Feedback function within the TOSCA assessment process

The main purpose of Feedback is to clarify organizational practices, explain assessment results, identify implementation challenges and supplement formal findings with contextual information.

Feedback discussions support validation of assessment conclusions, justification of identified strengths and weaknesses, preparation of SWOT analyses and development of Action Plans, capability development strategies and long-term organizational improvement activities.

4.9.5 Justification as a supporting mechanism

Justification is an evidentiary supporting mechanism within the TOSCA assessment process. It provides documentary and factual support for assessment conclusions, assigned ratings and organizational observations (Figure 26).

The methodology requires conclusions and ratings to be supported by objective, documented and verifiable information, rather than expert opinion or qualitative observations alone. Justification therefore ensures that assessment logic is transparent and that findings are traceable and evidence-based.

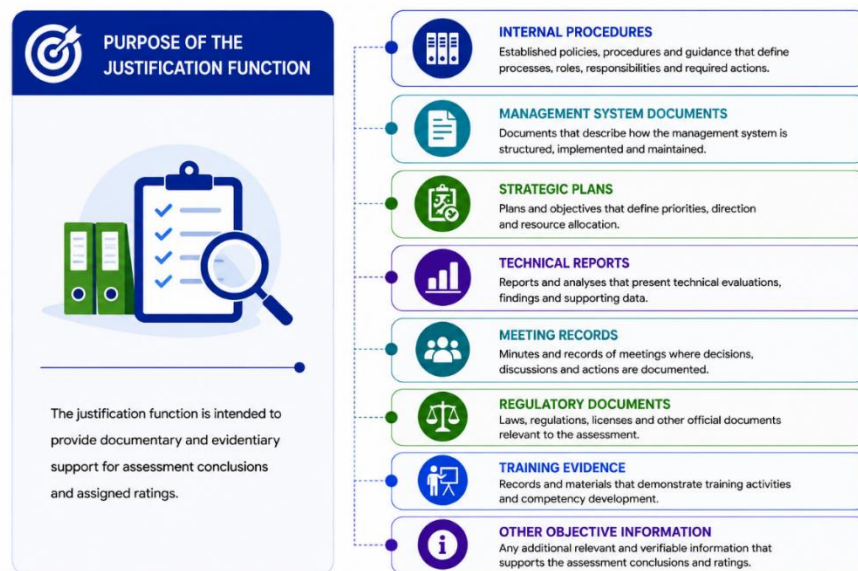


Figure 26. Justification function within the TOSCA assessment process

Supporting evidence may include management system manuals and procedures, organizational policies, strategic development plans, technical reports, meeting records, staffing and competence management records, regulatory documentation, training records and international cooperation materials.

Management system documents and internal procedures support evaluation of implementation maturity, organizational structure and operational practices. Strategic plans support evaluation of long-term priorities and sustainability planning. Technical reports and analytical studies provide evidence of technical competence and quality of support activities. Staffing, competence and training records are important for assessing competence development, succession planning and sustainability of expertise.

4.10 Demonstration and interpretation of assessment results

The TOSCA methodology provides a comprehensive set of analytical and visualization tools that support the presentation, interpretation and communication of assessment results. These tools enable organizations to transform individual questionnaire responses into consolidated information that can be used for management review, capability evaluation, identification of development priorities and preparation of improvement actions.

Following completion and validation of the self-assessment, results are aggregated and presented through graphical, comparative and tabular views (Figure 27). The methodology allows results to be analysed at different levels, including individual assessment topics, organizational functions, assessment pillars and overall organizational performance.



Figure 27. Demonstration and interpretation of assessment results

Before final approval of the assessment results, the designated FPPs and organizational management review the consolidated outputs to ensure consistency of ratings, adequacy of supporting evidence and alignment of conclusions across all assessment pillars. This review represents an important quality assurance step within the assessment process and provides the basis for subsequent SWOT analyses and Action Planning activities.

One of the principal analytical features of the methodology is the comparison between process ratings, performance ratings and corresponding benchmark values. This comparison allows organizations to evaluate not only how well activities are formally established and managed, but also how effectively they perform in practice. The methodology therefore supports assessment of both organizational arrangements and actual performance outcomes.

The TOSCA tool provides both bar-chart and radar-chart visualizations that facilitate comparison of results across assessment pillars and technical areas (Figure 28). These graphical representations help identify stronger and weaker capability areas, reveal imbalances between process and performance dimensions and support prioritization of future development activities.

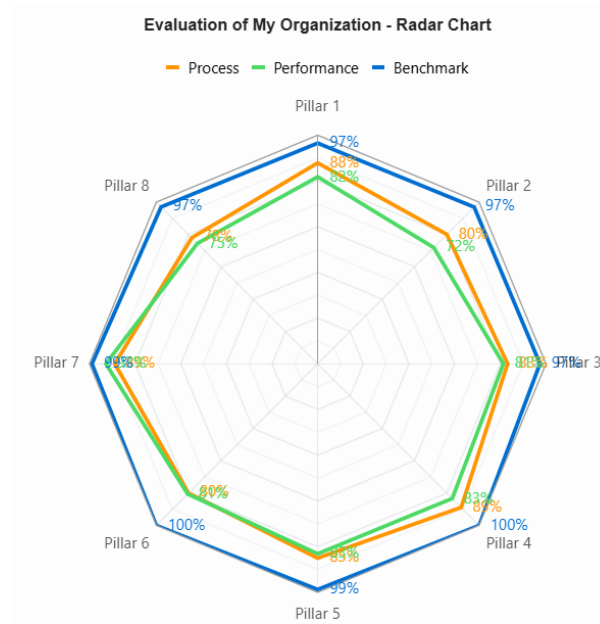


Figure 28. Comparison of process, performance and benchmark results across assessment pillars

Radar charts provide an integrated overview of organizational capabilities and illustrate the relative distribution of results among the assessment pillars. By displaying process, performance and benchmark values within a single graphical view, they allow users to quickly identify areas where capabilities are well developed and areas requiring additional attention.

Particular analytical value is provided by the degree of proximity between achieved ratings and corresponding benchmark values. A high degree of alignment generally indicates that the assessed capability has reached the expected level of maturity and effectiveness. Conversely, significant deviations between achieved ratings and benchmark values may indicate capability gaps, resource limitations, organizational weaknesses or strategic issues requiring further analysis and development.

These comparative analyses are particularly useful for identifying capability areas requiring strategic attention and for supporting preparation of organizational SWOT analyses. Comparison of process and performance ratings frequently helps distinguish between areas where formal arrangements already exist and areas where practical implementation or effectiveness requires further improvement.

The assessment tool also incorporates advanced filtering and result-selection functions that enable users to analyse results from different perspectives (Figure 29). Results may be filtered according to assessment pillar, analysis type (full-scope or partial assessment, broad or in-depth assessment), assessment orientation (process-oriented or performance-oriented assessment), Development Step, National Priority, rating level, respondent group and individual respondents. These functions support targeted analysis of specific capability areas and facilitate validation, management review and Action Planning activities.



Figure 29. TOSCA assessment results filtering and visualization interface

In addition to graphical views, the methodology provides detailed result tables containing assessment topics, analysis type, assessment orientation, assigned ratings, benchmark values, Development Steps and National Priorities (Figure 30). Together with recorded feedback, supporting justifications and associated SWOT elements, these tables ensure full traceability between assessment responses, analytical conclusions and proposed improvement actions.

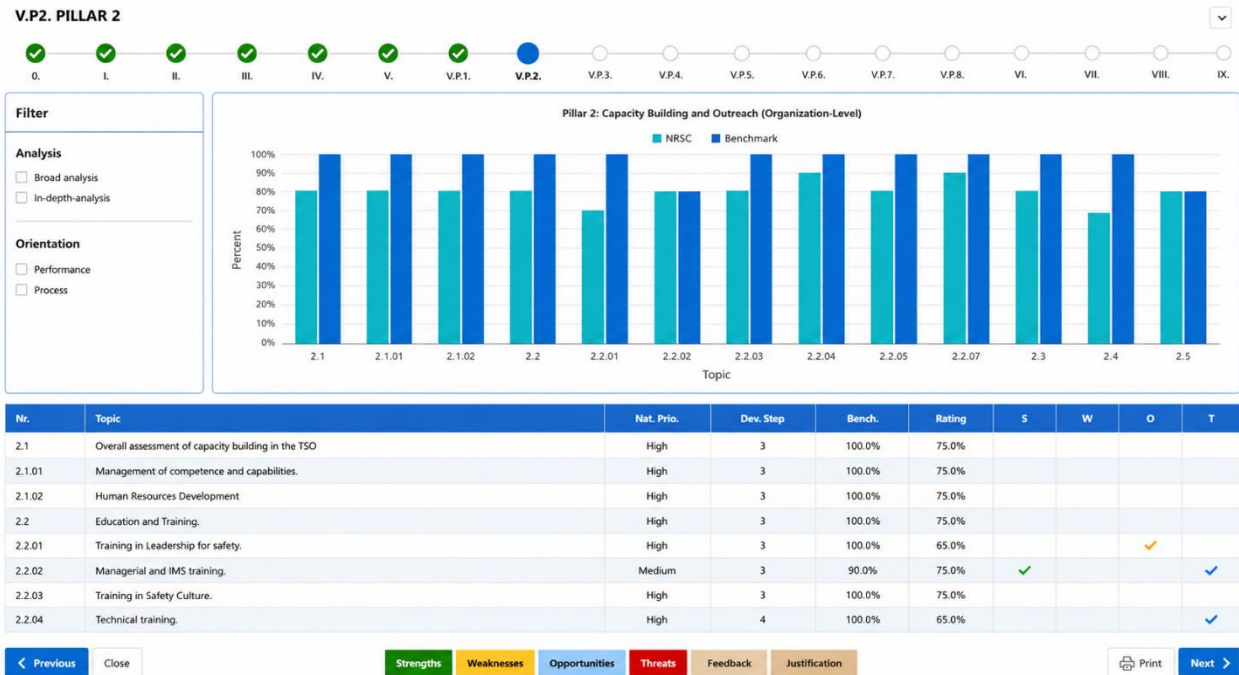


Figure 30. Detailed result table for assessment topics and parameters

The visualization and analytical capabilities of the TOSCA methodology therefore serve not only to present assessment results but also to support their interpretation and practical use. By systematically comparing process, performance and benchmark values, organizations are able to identify strengths, weaknesses, capability gaps and development priorities, thereby providing a justified basis for preparation of SWOT analyses, findings, recommendations and implementation-oriented Action Plans.

An important feature of the methodology is the logical progression from assessment results through SWOT analysis and organizational conclusions to Action Planning and continuous improvement (Figure 31). This traceable relationship ensures that proposed improvement measures are directly linked to assessment evidence and identified organizational needs.

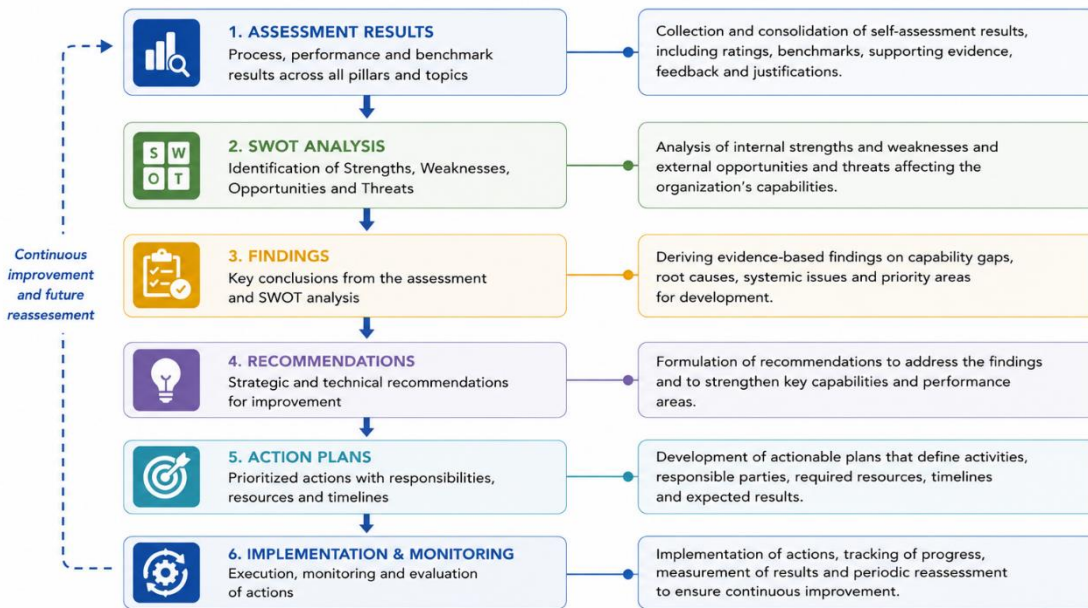


Figure 31. From assessment results to SWOT analysis, findings, recommendations and Action Plans

4.11 SWOT analysis and action planning within TOSCA

One of the key analytical components of the TOSCA methodology is the use of SWOT analysis as a structured mechanism for interpreting assessment results and translating them into practical improvement actions. Within the TOSCA framework, SWOT analysis is not performed as a separate exercise but constitutes an integral part of the assessment and result interpretation process (Figure 32).



Figure 32. SWOT analysis within the TOSCA methodology

Following completion of the self-assessment and review of the consolidated results, a more detailed analysis is performed within each assessment pillar. The objective of this analysis is to identify organizational strengths, weaknesses, opportunities and threats and to determine how existing capabilities can be further developed and strengthened.

Assessment results, including ratings, benchmark values, Development Steps, National Priorities, feedback and supporting justification, provide the analytical basis for SWOT development. The comparison between achieved ratings and benchmark values helps identify areas where capabilities are well established as well as areas requiring additional development, resource allocation or management attention.

The SWOT process is performed at the level of individual assessment topics within each pillar. For every topic, assessment respondents and FFPs analyse the available evidence and determine whether the identified conditions represent organizational strengths, weaknesses, opportunities or threats. This approach ensures full traceability between assessment results and SWOT conclusions and maintains a clear link to the original assessment logic.

The TOSCA assessment tool provides dedicated functionality for recording SWOT elements directly within the assessment environment (Figure 33). Strengths, weaknesses, opportunities and threats can be assigned to individual assessment topics together with supporting explanations and proposed actions. This enables systematic documentation of analytical conclusions and facilitates subsequent review and validation activities.

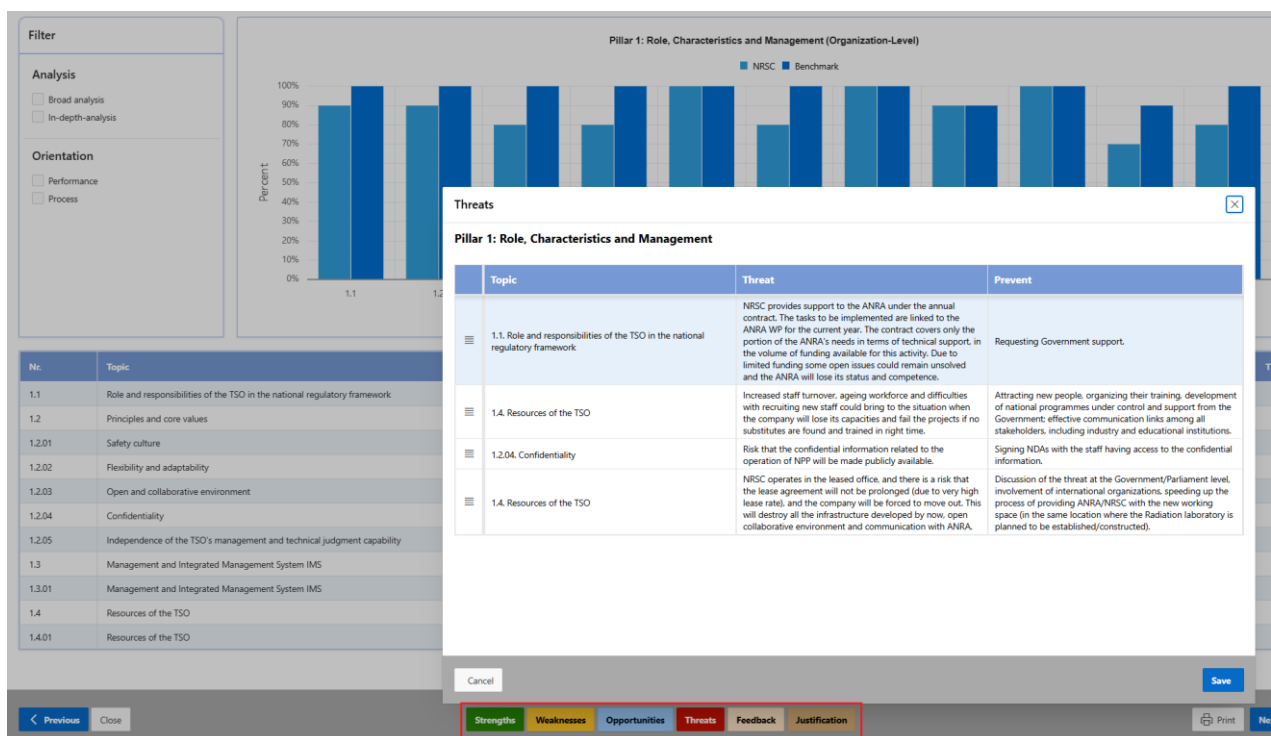


Figure 33. Example of SWOT analysis results within a TOSCA assessment pillar

SWOT analysis also benefits from expert discussion and validation. During review meetings and National Workshop discussions, participants examine whether identified strengths and weaknesses accurately reflect the organizational situation and whether opportunities and threats have been realistically assessed. Such discussions help ensure consistency of interpretation and improve the quality of the resulting recommendations.

The outputs of SWOT analysis constitute one of the principal inputs for development of findings, recommendations and Action Plans (Figure 34). Individual SWOT elements are reviewed, consolidated and prioritized in order to identify strategic development needs, capability gaps and improvement opportunities. This process ensures that Action Planning is based not only on numerical assessment ratings but also on a structured understanding of organizational strengths, weaknesses, external opportunities and potential risks.

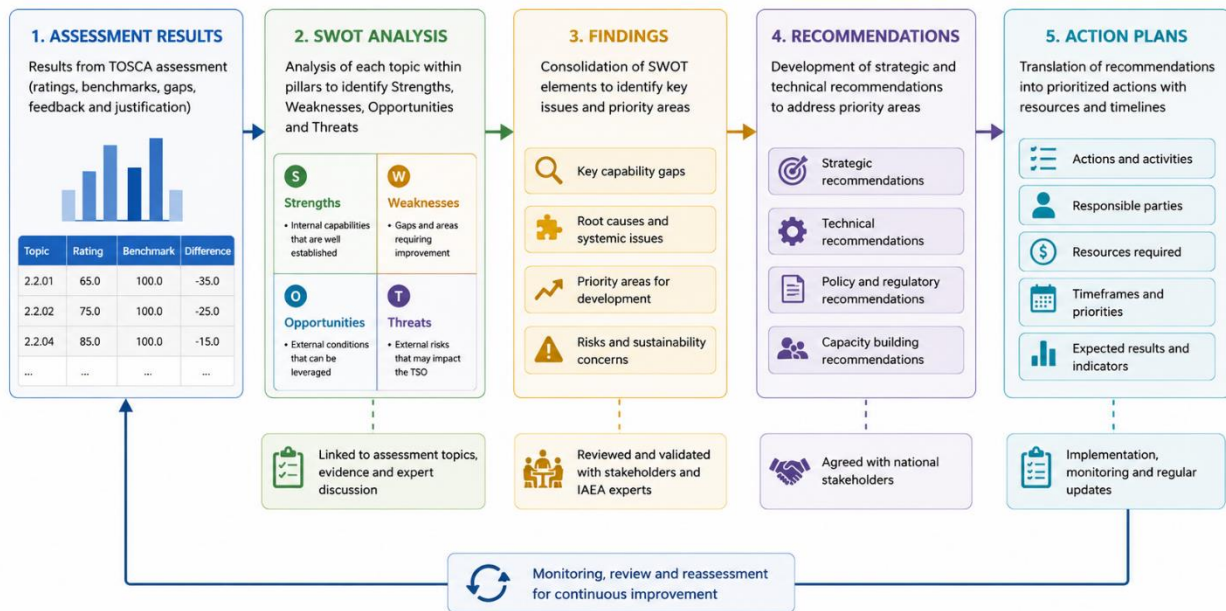


Figure 34. SWOT-based transition from assessment results to recommendations and Action Plans

The resulting Action Plans typically define improvement activities, implementation priorities and target timeframes. Through this structured approach, the TOSCA methodology establishes a direct link between assessment results, strategic analysis and implementation of improvement actions, thereby supporting continuous organizational development and future reassessment activities.

4.12 TOSCA reports

Preparation of reports represents the final stage of the TOSCA assessment process and serves as the primary mechanism for documenting, consolidating and communicating assessment results. The reporting process transforms assessment outputs into structured organizational and national-level conclusions that support decision-making, capability development planning, Action Planning and future re-assessment activities.

The purpose of TOSCA reporting is to ensure that assessment findings, ratings, SWOT analyses, feedback, justification records, recommendations and identified capability gaps are systematically documented, analyzed and transformed into practical improvement actions.

The TOSCA reporting methodology is based on a multi-level structure. Individual participating organizations prepare Organization Reports reflecting their respective perspectives, responsibilities and assessment results. These reports are then consolidated

into a National TOSCA Report, which provides an integrated view of the national technical and scientific support framework and related capability development need (Figure 35).

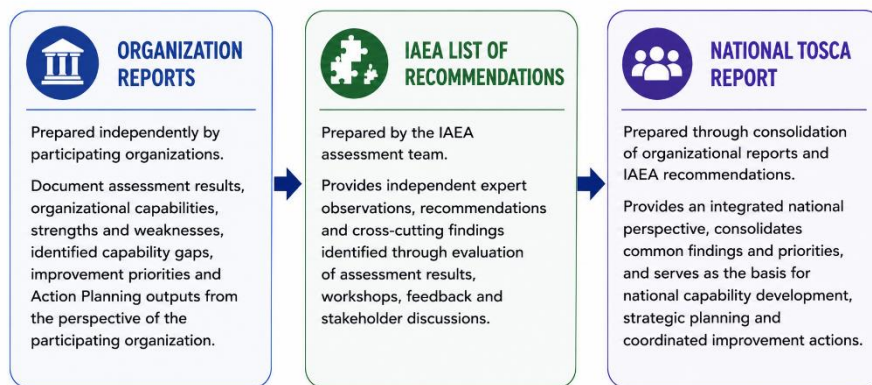


Figure 35. Relationship between Organizational Reports, IAEA recommendations and the National TOSCA Report

The Organization Reports document assessment results from the perspective of individual participating organizations. They serve as the principal records of organizational self-assessment activities and include organizational capabilities, strengths, weaknesses, development needs, improvement priorities and Action Planning outputs.

The National TOSCA Report represents the highest level of consolidation. It integrates organizational assessment results, common findings, cross-cutting issues, strategic development needs and national-level capability priorities. It provides a comprehensive overview of the technical and scientific support framework and supports development of coordinated national improvement actions and capability development programmes.

To facilitate comparison, consolidation and Action Planning, reports should follow a harmonized structure. A typical TOSCA report may include (Figure 36):

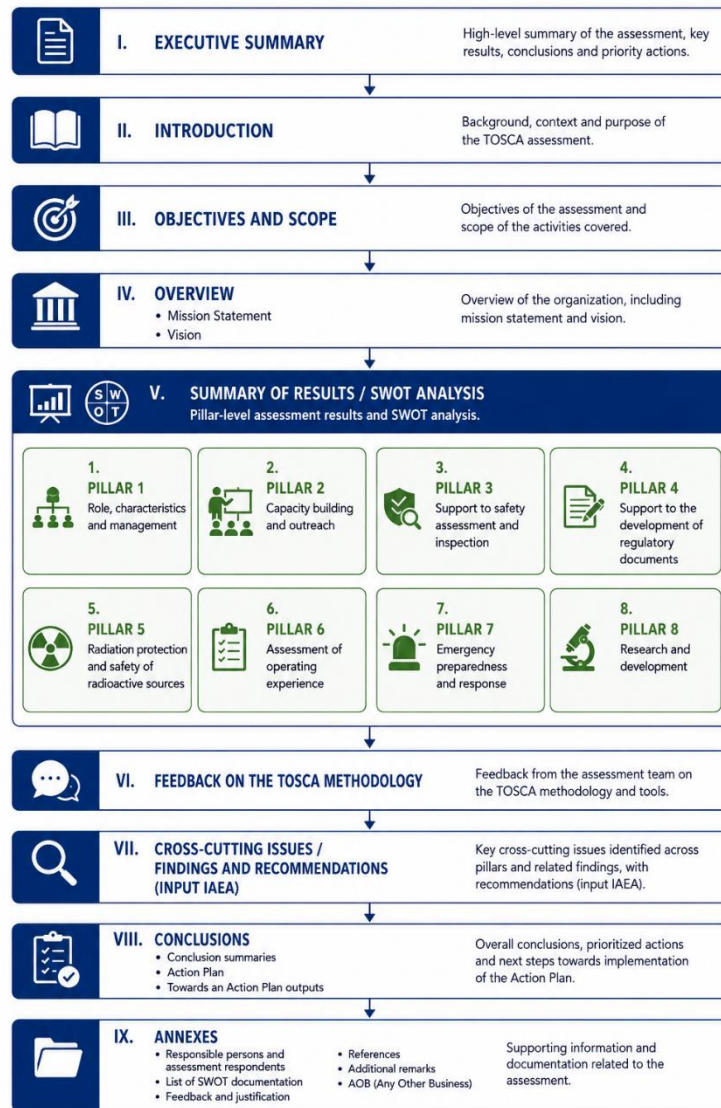


Figure 36. Typical structure of TOSCA reports

A key output of the reporting process is the development of Action Plans. The reports provide the analytical basis for transforming assessment findings into implementation-oriented actions. Ratings, SWOT analyses, recommendations, expert observations and identified capability gaps are consolidated and evaluated in order to define strategic priorities, development objectives and improvement measures.

Consequently, Action Planning is considered an integral part of the TOSCA reporting methodology. The reports serve not only as records of assessment results, but also as management tools supporting strategic planning, capability development, resource prioritization, monitoring of progress and continuous improvement.

Overall, the TOSCA reporting methodology provides a structured framework for documenting assessment results, consolidating organizational perspectives, integrating expert findings and recommendations, and translating assessment outcomes into coordinated organizational and national capability development actions. The reporting process therefore represents the final methodological step that transforms assessment results into practical and strategic measures supporting long-term sustainability and continuous development of technical and scientific support capabilities.

4.13 Action planning

Action Planning represents the final analytical stage of the TOSCA methodology. Its purpose is to transform assessment results into practical and strategic improvement measures supporting capability development, organizational effectiveness and long-term sustainability of technical and scientific support functions.

The principal inputs to Action Planning are:

- SWOT analysis results;
- expert findings and recommendations;
- cross-cutting issues identified during the assessment process.

SWOT analysis provides the organizational perspective by identifying strengths, weaknesses, opportunities and threats. Expert findings and recommendations provide an independent perspective and help identify strategic, technical and cross-cutting issues that may require attention.

Together, these inputs form the analytical basis for defining improvement priorities and preparing implementation-oriented Action Plans.

Within this process (Figure 37):

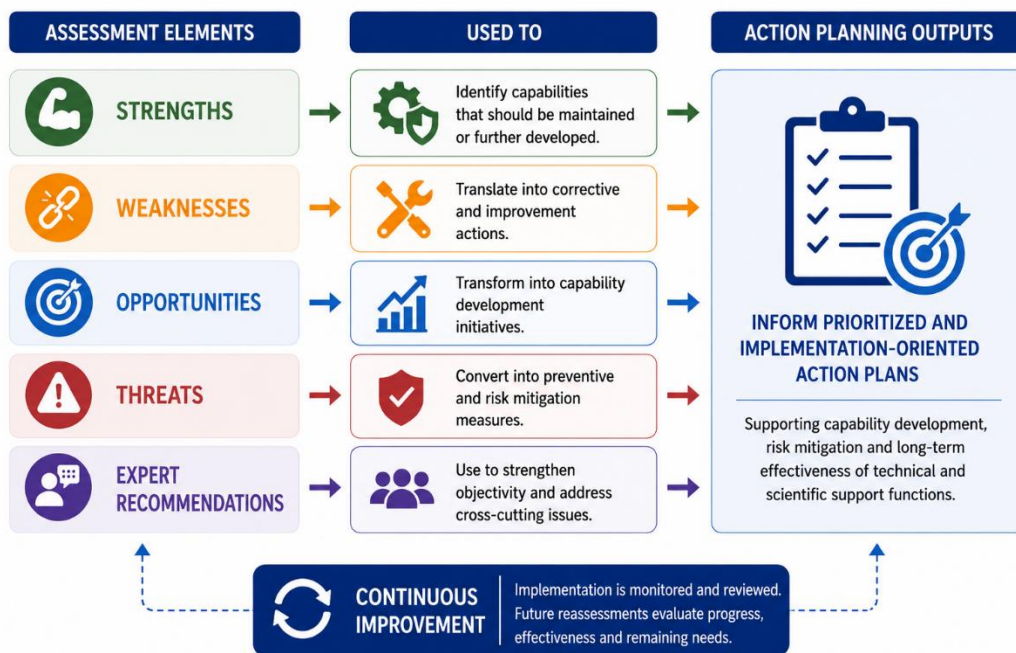


Figure 37. From assessment inputs to Action Planning outputs

The TOSCA methodology applies a three-stage Action Planning approach (Figure 38).

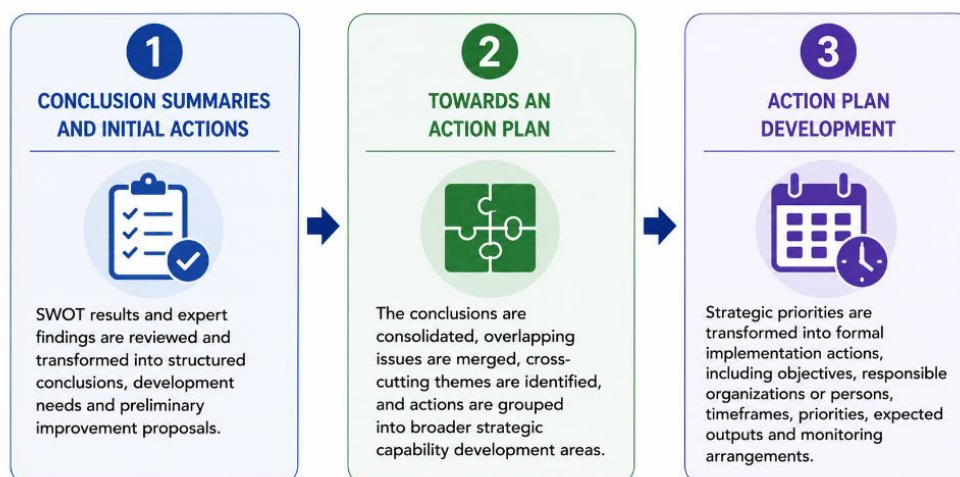


Figure 38. Three-stage Action Planning process within the TOSCA methodology

Action Planning is closely linked to continuous improvement. Implementation of actions should be monitored and reviewed, and future reassessments should evaluate progress, effectiveness of implemented measures and remaining development needs.

Overall, Action Planning ensures that TOSCA assessment outputs are not limited to diagnostic conclusions, but are translated into measurable, prioritized and sustainable improvement actions supporting long-term capability development and regulatory support effectiveness.

The following chapters describe how the TOSCA methodology was practically implemented in Armenia, including organization of the assessment process, stakeholder interaction, SWOT analyses, Action Planning activities and development of strategic capability goals and implementation-oriented national actions.

5. TOSCA application in Armenia

5.1 TOSCA self-assessment expectations

At the beginning of the TOSCA implementation in Armenia, NRSC and ANRA established a common understanding of the objectives, expected benefits and anticipated outputs of the assessment process. This helped align participants' expectations and provided a common vision for implementation of the methodology.

For NRSC, the assessment represented the first comprehensive international evaluation of its performance and capabilities as the TSO supporting ANRA since its establishment in 2001. Therefore, the assessment was viewed not only as a self-evaluation exercise, but also as a strategic opportunity to obtain an independent view of the organization's current capabilities, identify development needs and define future improvement priorities.

It should also be noted that the Armenian TOSCA implementation was performed using the *TOSCA Online Tool Release 1.0*, which was the version available at the time of the assessment. Practical feedback provided by NRSC and ANRA during implementation, together with feedback and implementation experience from other participating organizations, was subsequently considered in the further development of the tool. As a result, the updated *TOSCA Online Tool Release 2.0* became available. This demonstrates the continuous evolution of the methodology and the value of practical user feedback in supporting improvement of the TOSCA assessment framework and its associated software tools.

The main Armenian expectations from the TOSCA process were (Figure 39):

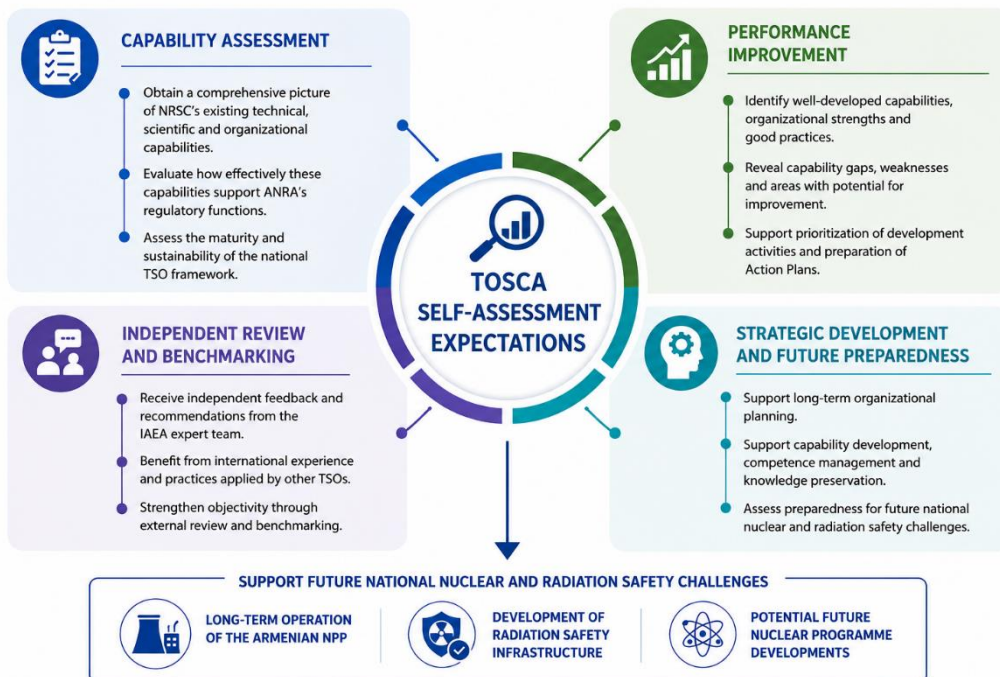


Figure 39. Armenia expectations from TOSCA implementation

Particular attention was given to technical competence and expertise, effectiveness of technical support activities, organizational and management arrangements, sustainability

of capabilities and resources, and the ability to respond to current and future regulatory needs.

5.2 Stakeholders and their approach to the assessment

The Armenian implementation of the TOSCA methodology was based on the involvement of three principal stakeholders:

- Nuclear and Radiation Safety Center (NRSC);
- Armenian Nuclear Regulatory Authority (ANRA);
- International Atomic Energy Agency (IAEA).

Each stakeholder participated in the assessment from its own institutional role and functional perspective (Figure 40). This created a collaborative and complementary assessment approach combining:

- internal organizational self-assessment;
- regulatory user perspective;
- independent international review.

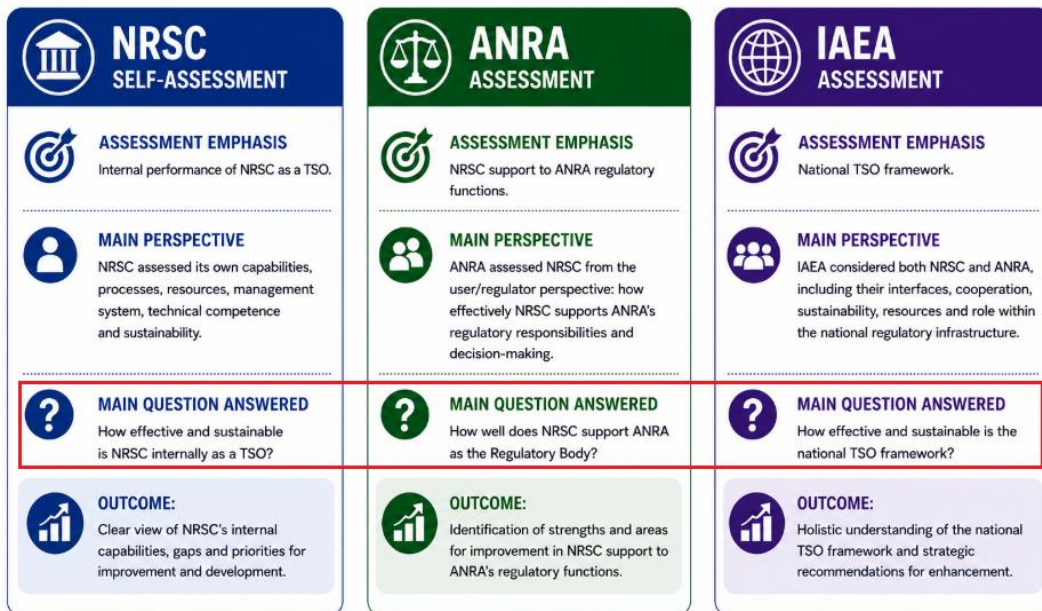


Figure 40. Armenia TOSCA self-assessment participants

A distinctive feature of the Armenian implementation was that both NRSC and ANRA performed independent assessments using the same TOSCA methodology and assessment framework. NRSC assessed its own technical, scientific and organizational capabilities as the national TSO, while ANRA evaluated the effectiveness and adequacy of the support received from NRSC in carrying out its regulatory functions. These complementary assessments were subsequently reviewed and discussed together with the observations of the IAEA expert team.

This multi-perspective approach provided an opportunity to compare and validate assessment results from different viewpoints, thereby improving the robustness, objectivity and credibility of the overall evaluation. It enabled the national TSO framework to be assessed not only from the perspective of the organization providing technical support, but

also from the perspective of the Regulatory Body receiving such support and from the independent perspective of international experts.

The approach also helped maintain a clear separation of responsibilities. ANRA retained full responsibility for regulatory decision-making, while NRSC provided technical and scientific support, and the IAEA contributed independent expert observations, benchmarking and recommendations without replacing national responsibilities or decision-making authority.

The combination of these three perspectives created an effective mechanism for validating assessment conclusions, identifying capability strengths and gaps, and establishing a common understanding of future development priorities. Overall, the Armenian implementation demonstrated that a multi-stakeholder assessment approach significantly enhances the completeness, objectivity and practical value of the TOSCA process and supports the development of a sustainable and strategically coordinated national technical support framework.

5.3 Scope of assessment

Definition of the assessment scope was one of the key preparatory activities performed during the Armenian implementation of the TOSCA methodology. The objective was to establish a realistic and manageable assessment framework while ensuring that the results would provide a comprehensive picture of the capabilities, effectiveness and sustainability of NRSC as the national TSO.

During the initial planning phase, consideration was given to conducting a partial assessment covering a limited number of TOSCA pillars. This approach was primarily driven by available resources, the anticipated workload associated with the assessment process and the fact that TOSCA was being applied in Armenia for the first time. A preliminary option considered assessment of four pillars, including both management-oriented and technical areas, in order to obtain an initial understanding of organizational capabilities while reducing implementation effort.

However, discussions held during the preparatory phase, together with analysis of the TOSCA methodology, assessment logic and evaluation criteria, demonstrated that such an approach would not provide a sufficiently complete understanding of organizational performance and development needs. The assessment team concluded that the TOSCA pillars are highly interconnected and cannot be effectively evaluated in isolation.

For example:

- management system effectiveness directly influences technical support activities;
- competence development affects all technical disciplines;
- knowledge management supports sustainability of expertise across all functional areas;
- research and development contribute to analytical capabilities and regulatory support functions;
- operating experience and emergency preparedness influence multiple technical and organizational processes.

It was also recognized that conducting only a partial assessment could result in duplication of effort in the future. If additional pillars were assessed at a later stage, previously

completed assessments would need to be revisited and updated to reflect cross-cutting findings and interactions between pillars. Consequently, a phased pillar-by-pillar implementation would likely require significant re-assessment and reduce the overall efficiency of the process.

Based on these considerations, Armenia decided to conduct a full-scope TOSCA assessment covering all eight assessment pillars (see Figure 41 and Section 4.5):



Figure 41. TOSCA assessment pillars

The decision to assess all pillars provided a comprehensive and integrated view of NRSC capabilities and enabled identification of both pillar-specific and cross-cutting organizational issues.

The Armenian implementation applied a broad and in-depth assessment approach (see Subsection 4.8). The objective was not only to obtain a high-level overview of capabilities but also to evaluate the maturity, effectiveness and sustainability of individual functions and supporting processes. Assessment activities therefore included detailed review of organizational arrangements, technical capabilities, competence management practices, management system elements, available resources and future development needs.

At the same time, the assessment remained focused on the actual activities and responsibilities of NRSC. Only those questions and assessment topics relevant to the organization's mandate, functions and capabilities were considered. Questions not applicable to the Armenian TSO model or outside the scope of NRSC activities were excluded from detailed evaluation.

The assessment was performed using the common evaluation framework defined by the TOSCA methodology. Across all pillars, particular attention was given to the following assessment criteria (Figure 42):



Figure 42. TOSCA assessment criteria

Evaluation of these criteria was based on document reviews, evidence collection, expert discussions, self-assessment activities and review of practical implementation results.

All pillars were assessed using both process-oriented and performance-oriented perspectives (see Subsection 4.8 and Figure 43).

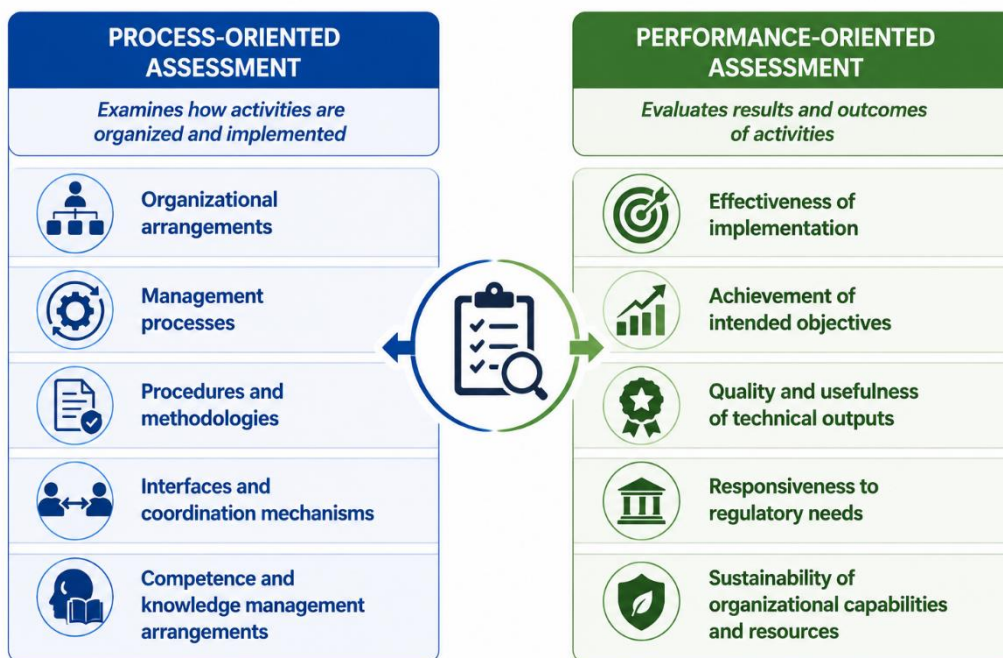


Figure 43. Process-oriented and performance-oriented perspectives

Application of these complementary perspectives allowed the assessment team to evaluate not only whether appropriate processes exist, but also whether they effectively support regulatory functions and produced the expected results.

The assessment process itself was based on structured questionnaires, evidence-based self-assessment, SWOT analyses, expert discussions, validation activities and independent review by the IAEA expert team. The resulting findings provided the basis for

development of organizational and national Action Plans aimed at strengthening the long-term effectiveness and sustainability of the Armenian regulatory support framework (Figure 44).

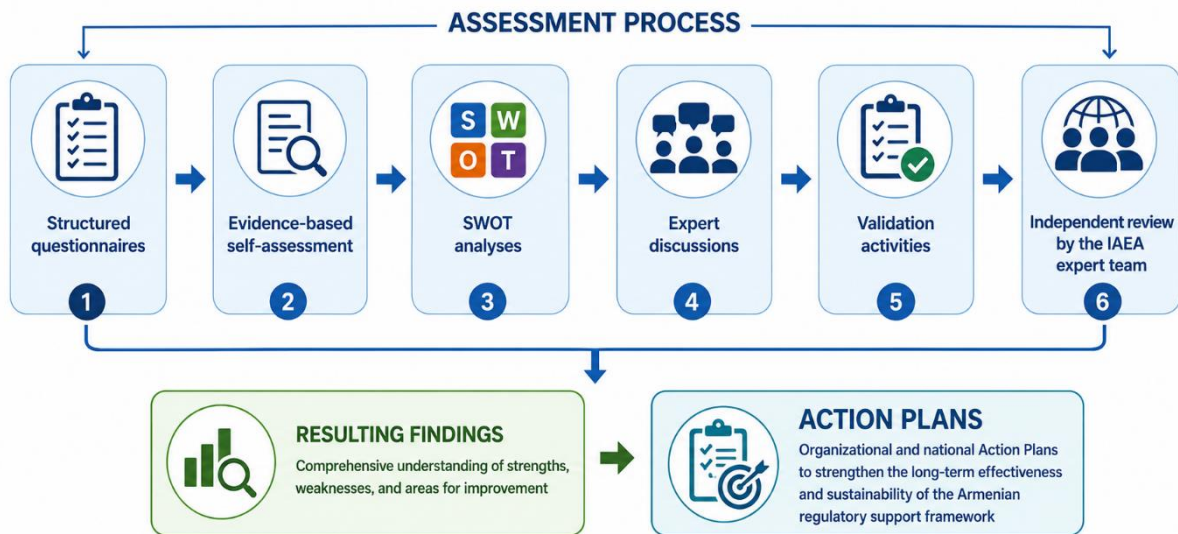


Figure 44. TOSCA assessment process and development of Action Plans

The Armenian experience demonstrated that conducting a full-scope assessment across all eight pillars significantly improved understanding of interdependencies between functional areas, strengthened the consistency of assessment results and provided a more reliable basis for strategic planning, capability development and future organizational improvement activities. In particular, the use of common evaluation criteria and simultaneous assessment of all pillars facilitated identification of cross-cutting issues related to competence management, knowledge preservation, resource sustainability and future capability development, which became key elements of the subsequent Action Plans.

5.4 Main milestones

Implementation of the TOSCA methodology in Armenia followed a phased and structured process, beginning with initial familiarization with the methodology and continuing through self-assessment, national discussions, reporting, Action Planning and implementation of improvement measures.

The Armenian experience demonstrated that TOSCA implementation should be considered not as a single assessment event, but as a continuous process combining preparation, assessment, validation, strategic planning and follow-up (Figure 45). The phased implementation approach ensured gradual development of understanding, effective stakeholder involvement, consistency of methodology application and successful transformation of assessment results into practical improvement actions.



Figure 45. Main milestones of TOSCA implementation in Armenia

The first milestone was familiarization with the TOSCA methodology and its potential application within the Armenian regulatory support framework. NRSC became interested in the methodology as a structured international approach for evaluating the capabilities, effectiveness and sustainability of TSOs supporting regulatory bodies.

An important milestone during the initiation phase was participation in the IAEA TOSCA Explanatory Meeting held on 19-21 February 2024 at IAEA Headquarters in Vienna, Austria, involving representatives of Armenia, Belarus, Ghana and Turkey (Figure 46).



Figure 46. IAEA TOSCA Explanatory Meeting (19-21 February 2024)

The meeting introduced the TOSCA methodology, assessment logic and supporting software tool. It also provided participating organizations with an opportunity to discuss implementation approaches, share initial expectations and exchange views on practical

aspects of applying the methodology within their respective national regulatory support frameworks.

The meeting played a significant role in Armenia's subsequent decision to proceed with implementation of the TOSCA methodology. Following the meeting, internal discussions were held within NRSC and ANRA regarding the feasibility, expected benefits and practical aspects of conducting a TOSCA assessment in Armenia.

As a result of these discussions, it was concluded that the methodology could provide significant value for evaluating existing capabilities, identifying development needs and supporting long-term strategic planning. At the same time, NRSC decided to join the IAEA TSO Forum in order to strengthen its engagement with the international TSO community, benefit from accumulated international experience and participate in activities related to TSO capability development and sustainability.

These activities ultimately resulted in the decision to formally request IAEA support for implementation of the TOSCA methodology in Armenia.

Following the internal evaluation of the methodology, Armenia submitted an official request to the IAEA expressing its interest in implementing the TOSCA methodology.

The next major milestone was the IAEA Preparatory Mission conducted in Yerevan on 25-26 June 2024 (Figure 47). This represented the first formal implementation activity and established the foundation for the subsequent assessment process.



Figure 47. Armenia TOSCA Preparatory Mission (25-26 June 2024)

The mission included:

- introduction to the TOSCA methodology and assessment principles;
- presentation of the TOSCA software tool;
- explanation of the structure and requirements of IAEA TECDOC-1835;
- clarification of assessment pillars and assessment logic;
- training on use of questionnaires, ratings, feedback and justification mechanisms;
- discussion of implementation arrangements, roles and responsibilities;

- agreement on the implementation schedule and expected outputs.

The mission established a common methodological understanding among all participants and created the basis for consistent implementation of the self-assessment process.

Following the Preparatory Mission, NRSC and ANRA carried out a series of national preparatory activities aimed at establishing the organizational framework necessary for implementation of the assessment (see Subsection 5.5). These activities included:

- formation of assessment teams;
- appointment of OR, FPPs and OARs;
- definition of assessment scope and boundaries;
- allocation of responsibilities;
- coordination meetings;
- establishment of communication and review mechanisms;
- planning of implementation milestones and deliverables.

The preparatory activities ensured organizational readiness and provided the necessary coordination mechanisms for effective implementation of the assessment process.

The next major milestone was implementation of the self-assessment process. NRSC and ANRA conducted separate assessments using the TOSCA tool, reflecting their respective organizational perspectives. The assessment activities included completion of questionnaires, assignment of ratings, preparation of feedback and justifications, collection of supporting evidence and internal review of assessment results.

Following completion of the questionnaires, SWOT analyses were performed for all assessment pillars that provided the principal analytical basis for subsequent preparation of conclusions, recommendations and Action Plans.

The National TOSCA Workshop held in Yerevan on 19-21 November 2024 represented the central milestone of the implementation process (Figure 48). Representatives of NRSC, ANRA and the IAEA expert team reviewed the self-assessment results, discussed SWOT analyses and validated the principal assessment conclusions. The workshop also provided the basis for the independent IAEA assessment and the subsequent development of findings, recommendations and Action Plans (see Subsection 5.9.4).

Following the National TOSCA Workshop, an NRSC representative participated in the IAEA International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations (TSOs): Challenges and Opportunities in a Rapidly Changing World, held on 2-6 December 2024 at IAEA Headquarters in Vienna, Austria, and presented the Armenian experience in the application of the TOSCA methodology during the dedicated special session on TOSCA. This provided an opportunity to share Armenia's practical implementation experience with the international community and to contribute to discussions on the further application and development of the methodology.

Following completion of the workshop, NRSC and ANRA developed their respective Organization Reports and Action Plans (see Subsections 5.7-5.10). The assessment results, SWOT analyses and IAEA recommendations were subsequently consolidated into the National TOSCA Report and a national-level Action Plan.

The reports and Action Plans were reviewed and validated by the national authorities to ensure consistency, completeness and organizational ownership of the results.

At the time of preparation of this Case Study, the reports and Action Plans have been finalized and validated at the national level and are planned to be submitted to the IAEA for review and validation in the nearest future.

Although final IAEA validation is still pending, implementation of several Action Plan activities has already commenced. This decision was taken because many of the identified actions address strategic and high-priority areas related to:

- sustainability of technical and scientific support capabilities;
- human resource and competence development;
- knowledge management;
- communication and stakeholder engagement;
- research and development;
- strengthening of the national regulatory support framework.

The Armenian experience demonstrated that where assessment results clearly identify important strategic development needs, implementation of priority actions may begin before completion of the formal validation process, provided that national consensus and organizational commitment have already been established.

Implementation of the Action Plans represents the beginning rather than the end of the TOSCA process. The final milestone consists of monitoring implementation progress, evaluating effectiveness of completed actions and periodically reviewing achievement of established objectives (Figure 48).

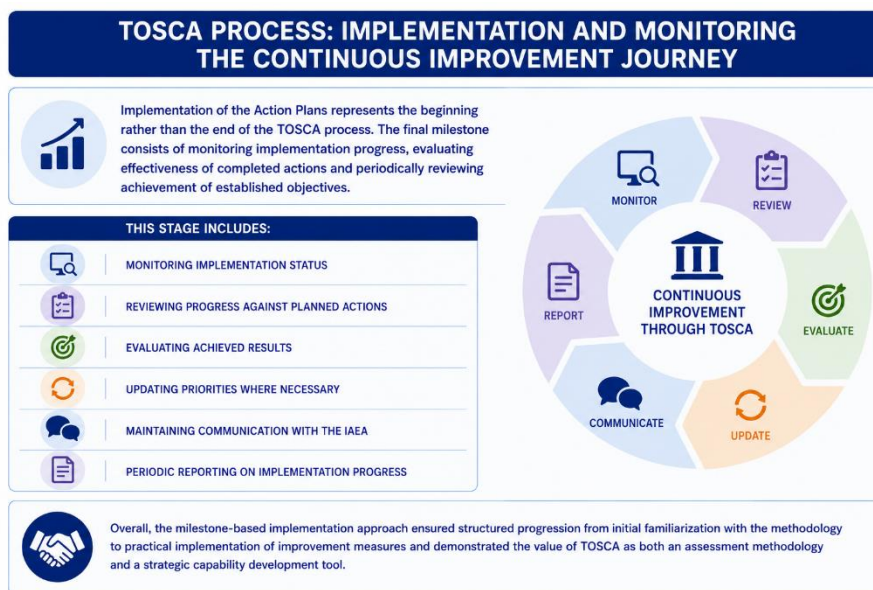


Figure 48. Continuous improvement framework for implementation of TOSCA Action Plans

This stage includes:

- monitoring implementation status;
- reviewing progress against planned actions;
- evaluating achieved results;
- updating priorities where necessary;
- maintaining communication with the IAEA;
- periodic reporting on implementation progress.

Overall, the milestone-based implementation approach ensured structured progression from initial familiarization with the methodology to practical implementation of improvement measures and demonstrated the value of TOSCA as both an assessment methodology and a strategic capability development tool.

5.5 Preparatory steps

The preparatory phase represented one of the most important stages of the TOSCA implementation in Armenia. The experience demonstrated that the quality, consistency and effectiveness of the assessment largely depend on the completeness of preparatory activities conducted before the self-assessment begins.

The main objectives of the preparatory phase were to:

- establish the assessment structure and assign responsibilities;
- ensure common understanding of the TOSCA methodology;
- define the assessment scope and implementation arrangements;
- establish communication and coordination mechanisms;
- plan implementation milestones and deliverables.

The preparatory activities were implemented jointly by NRSC and ANRA with support and guidance from the IAEA (Figure 48).



Figure 48. Armenia TOSCA preparatory activities

One of the first activities was establishment of the assessment teams within NRSC and ANRA. The teams included management representatives and technical experts.

The Armenian experience demonstrated that involvement of personnel with different technical and organizational backgrounds significantly improved the completeness of the assessment, the quality of discussions and the consistency of findings.

Following establishment of the assessment structure, a series of coordination meetings were organized involving representatives of NRSC and ANRA.

The meetings were used to:

- agree on the assessment approach and implementation sequence;
- review the TOSCA methodology and assessment logic;
- clarify assessment criteria and evidence requirements;
- define the scope and boundaries of the assessment;
- establish communication and coordination arrangements.

The Armenian experience demonstrated that these meetings were essential for ensuring a common understanding of the methodology and reducing differences in interpretation between participants.

Particular attention was given to clarifying the expected level of detail for ratings, feedback and justifications, as well as to defining the organizational interfaces and technical areas to be included within the assessment scope.

Another important preparatory activity was development of the implementation schedule and identification of key milestones.

The planning process included definition of:

- assessment phases and timelines;
- review and validation activities;
- workshops and meetings;
- reporting milestones;
- expected deliverables and outputs.

The main milestones included:

- completion of self-assessment activities;
- preparation of SWOT analyses;
- conduct of the National TOSCA Workshop;
- consolidation of findings and recommendations;
- preparation of Organization Reports;
- development of Action Plans;
- preparation of the National TOSCA Report.

In parallel, mechanisms for progress monitoring, coordination and issue resolution were established to support implementation throughout the assessment process.

5.6 Roles in TOSCA self-assessment

Successful implementation of the TOSCA self-assessment in Armenia required participation of representatives from both NRSC and ANRA. Since the assessment was conducted separately by the two organizations, each established its own assessment team and internal coordination arrangements.

The assessment structure was designed to ensure:

- involvement of personnel with relevant technical expertise;
- objective evaluation of assessed areas;
- effective coordination of activities;
- consistency of results;
- traceable review and approval of outputs.

The assessment teams in both organizations were organized using three levels of responsibility (Figure 49):



Figure 49. Assessment teams

- Organization Responsible (OR);
- Focal Points for TOSCA Pillars (FPPs);
- Organization Assessment Respondents (OARs).

The OR represents the highest coordination and approval level. In Armenia, this function was assigned to management representatives with sufficient authority and organizational knowledge to supervise the assessment, monitor progress, appoint FPPs for TOSCA pillars, review outputs and formally approve results on behalf of the organization. This strengthened management ownership and alignment with organizational priorities.

For each TOSCA pillar, FPPs were appointed from among experienced experts familiar with the corresponding field. They were selected based on technical competence, knowledge of organizational activities, understanding of existing strengths and challenges, coordination ability and capacity to provide objective professional judgement. Their main role was to coordinate pillar-level assessment activities, identify relevant topics, nominate and coordinate respondents, review completed questionnaires, facilitate discussions, consolidate results and approve pillar outputs before organizational review.

OARs were technical experts responsible for detailed assessment of assigned topics and questions. They were selected from among specialists with practical experience and knowledge of the relevant technical or organizational areas. Their responsibilities included completing questionnaires, assigning ratings, preparing feedback and comments, collecting supporting evidence, preparing justification materials and participating in discussions and validation activities.

The assessment followed a structured workflow (Figure 50):

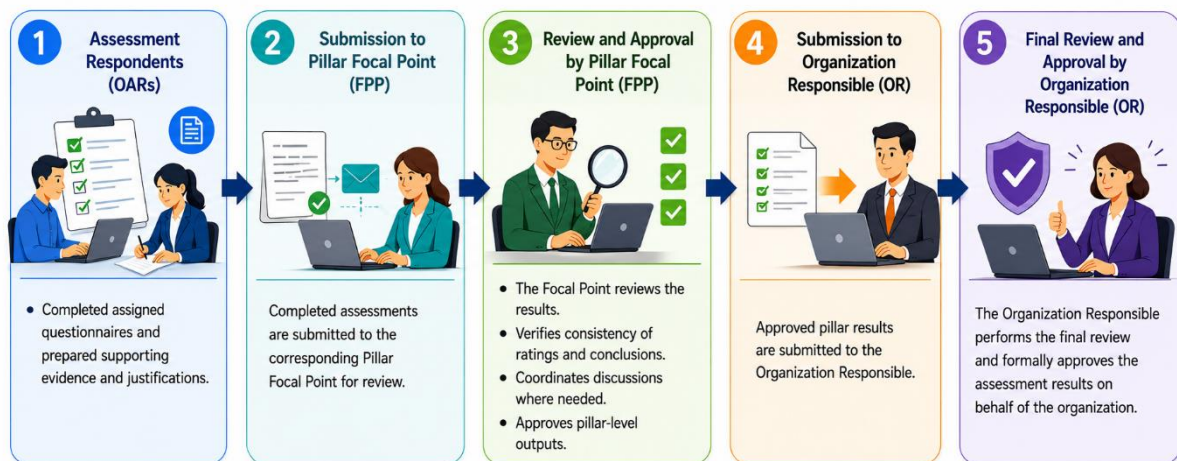


Figure 50. Assessment workflow

This multi-level process ensured quality control, consistency, traceability and organizational ownership of the final results.

The Armenian implementation also demonstrated the value of flexibility in assigning roles. In several cases, the same experts acted both as ARs and FPPs for one or more pillars, which was effective where specialized expertise was concentrated in a limited number of personnel. The experience confirmed that FPPs should combine technical competence with broad understanding of the real situation in the organization and assessed field, enabling objective evaluation of strengths, weaknesses, development needs and future challenges.

5.7 TOSCA reports

Preparation of reports represented one of the final and most important stages of the TOSCA implementation in Armenia. The reporting process transformed the results of the self-assessment, SWOT analyses, National TSO Workshop discussions and IAEA expert recommendations into structured conclusions, development priorities and Action Plans.

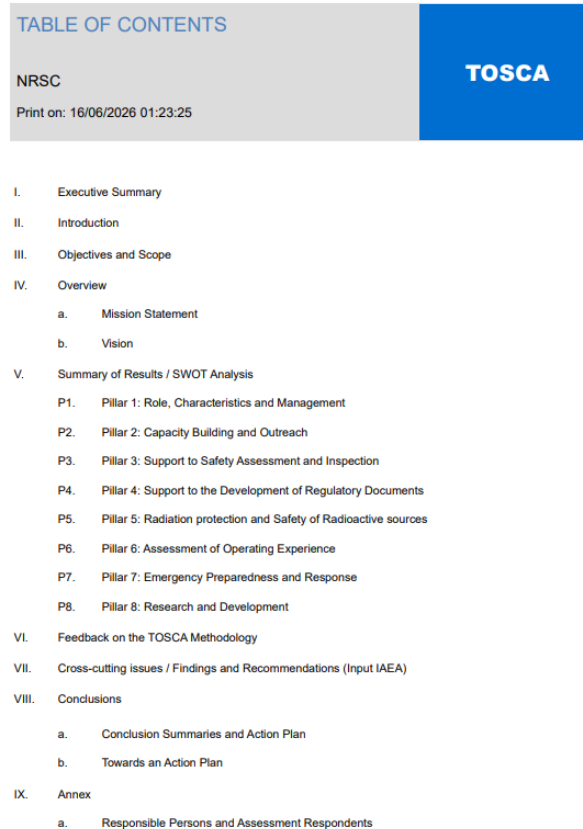
The reports were prepared in the online TOSCA tool, following the structure proposed by the IAEA. This helped ensure consistency of reporting, traceability of assessment results and comparability between organizational and national outputs.

The Armenian implementation involved preparation of:

- NRSC Organization Report;
- ANRA Organization Report;
- IAEA List of Recommendations and findings;
- National TOSCA Report.

The NRSC and ANRA reports were taking into account their different approaches to the assessment. NRSC prepared its report from the perspective of the assessed TSO, focusing on its internal organizational capabilities, technical competence, management arrangements, analytical and research capabilities and sustainability of expertise. ANRA prepared its report from the perspective of the Regulatory Body receiving technical and scientific support, focusing on the effectiveness, adequacy and sustainability of NRSC support to ANRA's regulatory functions.

The introductory part of each report described the objectives and scope of the assessment, the national and organizational context, and the link between the assessment and the mission, vision, role and responsibilities of the respective organization. The reports then provided detailed assessment results for each TOSCA pillar, including ratings, findings, SWOT analyses, identified strengths, weaknesses, opportunities, threats and areas requiring further development (Figure 51).



The image shows a 'TABLE OF CONTENTS' for NRSC, dated 16/06/2026 01:23:25. It features a blue header with 'TOSCA' and a list of sections from I to IX, including Executive Summary, Introduction, Objectives and Scope, Overview, Summary of Results / SWOT Analysis (with sub-sections P1-P8), Feedback on the TOSCA Methodology, Cross-cutting issues / Findings and Recommendations (Input IAEA), Conclusions, and Annex.

TABLE OF CONTENTS	
NRSC	TOSCA
Print on: 16/06/2026 01:23:25	
I.	Executive Summary
II.	Introduction
III.	Objectives and Scope
IV.	Overview
a.	Mission Statement
b.	Vision
V.	Summary of Results / SWOT Analysis
P1.	Pillar 1: Role, Characteristics and Management
P2.	Pillar 2: Capacity Building and Outreach
P3.	Pillar 3: Support to Safety Assessment and Inspection
P4.	Pillar 4: Support to the Development of Regulatory Documents
P5.	Pillar 5: Radiation protection and Safety of Radioactive sources
P6.	Pillar 6: Assessment of Operating Experience
P7.	Pillar 7: Emergency Preparedness and Response
P8.	Pillar 8: Research and Development
VI.	Feedback on the TOSCA Methodology
VII.	Cross-cutting issues / Findings and Recommendations (Input IAEA)
VIII.	Conclusions
a.	Conclusion Summaries and Action Plan
b.	Towards an Action Plan
IX.	Annex
a.	Responsible Persons and Assessment Respondents

Figure 51. Table of content of TOSCA reports

The reports also included separate sections on:

- feedback on the TOSCA methodology;
- IAEA recommendations and cross-cutting findings;
- additional remarks, AOB and lessons learned;
- conclusions and Action Planning outputs;
- annexes with supporting information, feedback, justification and references.

A key feature of the Armenian reporting approach was the integration of the IAEA recommendations into the organizational reports. This ensured that the IAEA expert findings were not treated as a separate external input only, but were directly considered in the conclusions and Action Plans of NRSC and ANRA.

The National TOSCA Report consolidated the results of the NRSC and ANRA Organization Reports, SWOT analyses and IAEA recommendations. It provided an integrated national-level view of the Armenian TSO framework and identified common strengths, cross-cutting issues, strategic development needs and national capability development priorities.

The final output and the main concluding element of all reports is the Action Plan (see Subsection 5.10). The Action Plan translated assessment findings, SWOT results and IAEA recommendations into practical improvement measures, responsible actions and

implementation priorities. In this sense, the reports were not only documentation of the assessment process, but also practical instruments for strategic planning and long-term capability development.

Draft reports, including Action Plans were reviewed and validated by NRSC and ANRA to ensure consistency, completeness, traceability and organizational ownership of the results. At the time of preparation of this Case Study, the reports had been finalized and validated at the national level and were planned to be submitted to the IAEA for review and validation.

Overall, the Armenian experience demonstrated that preparation of structured TOSCA reports is essential for preserving assessment results, integrating organizational and expert perspectives, documenting lessons learned and transforming assessment outputs into implementation-oriented Action Plans for strengthening the national regulatory support framework.

5.8 IAEA findings

An important component of the Armenian implementation of the TOSCA methodology was the independent assessment performed by the IAEA expert team during the National TOSCA Workshop held in Yerevan on 19-21 November 2024 (see Section 5.4, Subsection 5.9.4).

The purpose of the IAEA assessment was to provide an independent external perspective on the capabilities, effectiveness and sustainability of the national TSO (NRSC) and its support to the ANRA. The assessment was performed on the basis of the completed self-assessments, SWOT analyses, supporting documentation, workshop presentations, interviews, discussions and observations made during the implementation process.

Unlike the organizational self-assessments, which reflected the perspectives of NRSC and ANRA respectively, the IAEA findings (Figure 52) provided an independent international view based on the TOSCA methodology, IAEA TECDOC-1835 and relevant international good practices. The findings therefore served both as validation of existing strengths and as a source of recommendations for future capability development.



Figure 52. IAEA findings

The IAEA assessment identified a number of positive findings related to the Armenian regulatory support framework. In particular, the experts recognized NRSC as a credible, independent and full-scope TSO capable of supporting ANRA across its assigned regulatory responsibilities. The assessment also highlighted the strong cooperation between ANRA and NRSC, effective stakeholder interaction mechanisms, and continuity of technical support provided to the Regulatory Body. These observations confirmed the maturity and effectiveness of the existing national TSO framework and provided additional confidence in the sustainability of the current regulatory support arrangements.

At the same time, the IAEA assessment identified several strategic areas requiring continued attention and development. The recommendations focused primarily on long-term sustainability rather than short-term corrective actions and addressed both organizational and national-level challenges. Particular emphasis was placed on:

- strengthening human resource and competence development programmes;
- attracting and retaining young professionals;
- maintaining a systematic knowledge management approach;
- strengthening cooperation and information exchange at national and international levels;
- establishing and operating the National Radiation Laboratory;
- enhancing research and development capabilities;
- ensuring sustainability of technical expertise and resources;
- preparing for future challenges associated with long-term operation, new nuclear technologies, decommissioning and radioactive waste management.

A notable characteristic of the IAEA recommendations was their strategic nature. The majority of recommendations were directed toward ensuring future preparedness and sustainability of the national regulatory support system rather than addressing deficiencies in current performance. The findings emphasized the importance of proactive planning, competence development, knowledge preservation and capability enhancement in view of future national nuclear programme developments.

The Armenian implementation demonstrated that the IAEA findings became one of the principal inputs to the subsequent Action Planning process. The recommendations were systematically reviewed together with the NRSC and ANRA SWOT analyses and were incorporated into the organizational and national Action Plans. As a result, the IAEA recommendations contributed directly to the identification of strategic priorities, capability development objectives and implementation measures.

The complete list of IAEA findings, observations and recommendations identified during the National TOSCA Workshop is provided in Appendix B of this Case Study. The Appendix contains the full set of recommendations together with their corresponding findings, priorities and proposed improvement actions as documented during the Armenian implementation.

Overall, the IAEA assessment provided an important independent validation of the Armenian TSO framework while simultaneously identifying strategic development directions necessary for ensuring the long-term effectiveness, sustainability and resilience of the national regulatory support system. The findings became a key input to the Action Planning process and contributed significantly to the development of both organizational and national capability enhancement programmes.

5.9 Self-assessment and SWOT analysis

5.9.1 Overview of the assessment process

The self-assessment and SWOT analysis constituted the core analytical component of the Armenian implementation of the TOSCA methodology. The objective of this phase was to evaluate the capabilities, effectiveness and sustainability of the NRSC, identify strengths and improvement areas, and establish the analytical basis for development of organizational and national Action Plans.

The Armenian implementation applied the TOSCA methodology in its full scope and covered all eight assessment pillars. Both broad and in-depth assessment approaches were applied simultaneously in order to obtain a comprehensive understanding of organizational capabilities while also evaluating detailed technical and organizational aspects of TSO performance.

The assessment process was implemented in two sequential stages:

- completion of TOSCA questionnaires and ratings;
- development of SWOT analyses based on assessment results.

The process was performed separately by NRSC and ANRA, reflecting their different roles within the national regulatory framework.

5.9.2 Assessment perspectives

A distinctive feature of the Armenian implementation was the use of two complementary assessment perspectives.

5.9.2.1 NRSC self-assessment

NRSC performed a self-assessment of its own organizational and technical capabilities as the national TSO supporting ANRA.

The assessment focused on (Figure 53):



Figure 53. Key areas evaluated during the NRSC self-assessment

The objective was to evaluate NRSC's capability to continue providing competent and independent technical support to the Regulatory Body both at present and in the future.

5.9.2.2 ANRA assessment

ANRA assessed the adequacy, effectiveness and sustainability of the technical and scientific support provided by NRSC for implementation of regulatory functions.

The assessment focused on (Figure 54):



Figure 54. Key areas evaluated during the ANRA assessment

This approach provided an important customer perspective regarding the quality and sustainability of TSO support.

5.9.3 Practical implementation of the assessment

The Armenian implementation demonstrated that successful application of the TOSCA methodology required intensive interaction between assessment participants and subject matter experts (Figure 55).



Figure 55. Practical implementation of the TOSCA self-assessment

Assessment activities were organized through a series of dedicated meetings and workshops involving experts from NRSC and ANRA.

Questionnaires were completed using the TOSCA online assessment platform. Assessment participants reviewed each question, discussed interpretation of the requirements, examined available evidence and agreed on approach to rating before entering responses into the system.

Although questionnaires were completed individually through the online tool, the assessment process itself was highly collaborative. Experts frequently worked together to discuss assessment criteria, review supporting documentation and ensure consistency of interpretation across different pillars.

This approach contributed to:

- consistency of ratings;
- common understanding of assessment criteria;
- improved quality of justifications;
- identification of cross-cutting issues;
- organizational learning and knowledge exchange.

5.9.4 National TOSCA Workshop and independent IAEA assessment

A key milestone of the Armenian implementation was the National TOSCA Workshop held in Yerevan on 19-21 November 2024 with participation of representatives of NRSC, ANRA and the IAEA expert team (Figure 56).



Figure 56. Armenia National TOSCA Workshop (19-21 November 2024)

The workshop served as the principal forum for presentation, review and discussion of the assessment results developed by NRSC and ANRA during the self-assessment phase. The results of the questionnaire-based assessments and SWOT analyses were presented pillar-by-pillar and discussed collectively by participants.

The workshop provided an opportunity to:

- review and validate assessment results;
- discuss strengths, weaknesses, opportunities and threats identified by the organizations;
- compare different organizational perspectives;
- clarify assessment findings and supporting evidence;
- identify common themes and cross-cutting issues;
- discuss future capability development needs and improvement priorities.

An important feature of the workshop was the independent evaluation performed by the IAEA expert team. Using the information provided through the self-assessments, SWOT analyses, supporting documentation, presentations, interviews and discussions, the IAEA experts conducted their own assessment of the Armenian TSO framework.

The IAEA assessment was performed independently from both NRSC and ANRA assessments and provided an external international perspective based on the TOSCA methodology, IAEA TECDOC-1835 and international good practices.

As a result of the workshop, three complementary assessment perspectives became available:

- NRSC self-assessment perspective;
- ANRA assessment perspective regarding technical support received from NRSC;
- independent IAEA assessment perspective.

The findings and recommendations identified by the IAEA experts subsequently became an integral input to the Action Planning process and were incorporated into the organizational reports and Action Plans prepared by both NRSC and ANRA.

The workshop also provided an important platform for discussion of assessment results, comparison of organizational and external perspectives, and development of a common understanding of the strategic priorities requiring further attention.

5.9.5 Development of SWOT analyses

Following completion of the questionnaire-based self-assessments and consolidation of assessment results, separate SWOT analyses were developed by NRSC and ANRA as an integral part of the TOSCA methodology (Figure 57).

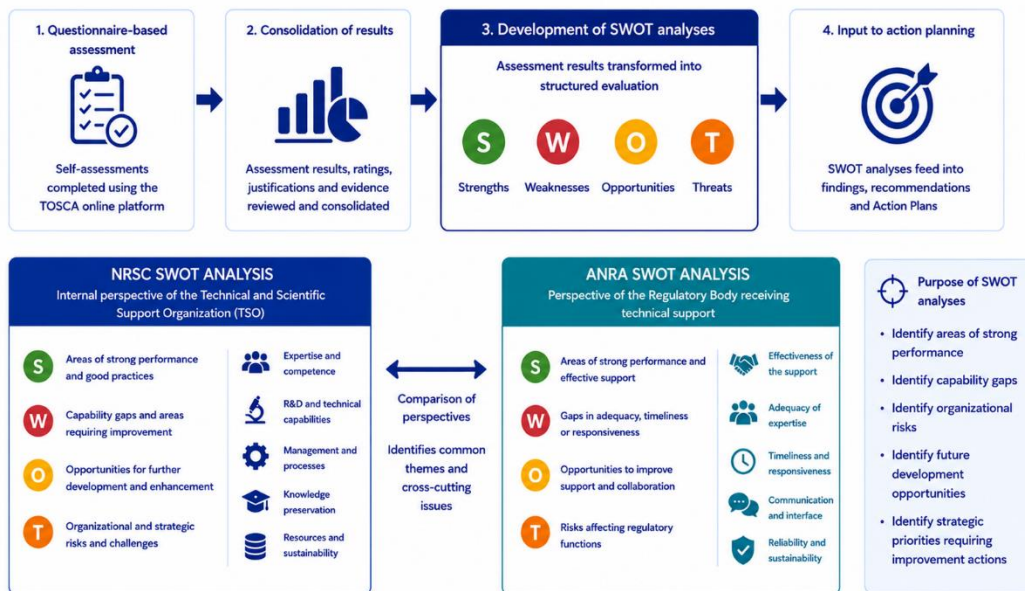


Figure 57. Development and application of SWOT analyses within the TOSCA assessment process

Within the TOSCA framework, SWOT analysis serves as a bridge between detailed assessment results and the subsequent identification of findings, recommendations and improvement actions. Rather than representing a separate analytical exercise, the SWOT analyses were directly derived from the assessment results, ratings, supporting evidence, feedback and justification developed during the self-assessment process.

The SWOT analyses transformed detailed assessment information into a structured evaluation of:

- Strengths;
- Weaknesses;
- Opportunities;
- Threats.

This process enabled the assessment teams to move beyond individual questionnaire responses and identify broader organizational patterns, cross-cutting issues, strategic development needs and improvement priorities affecting the long-term effectiveness and sustainability of the national TSO framework.

The SWOT analyses were used to identify:

- areas of strong performance and established good practices;
- capability gaps and areas requiring improvement;

- organizational and strategic risks that could affect future performance;
- opportunities for further development and enhancement of capabilities;
- priorities requiring management attention and future actions.

Separate SWOT analyses were prepared by NRSC and ANRA in order to preserve the distinct perspectives of the participating organizations and to allow comparison between the internal TSO perspective and the perspective of the Regulatory Body receiving technical support.

The practical application of this approach within the Armenian implementation is illustrated through the separate SWOT analyses prepared by NRSC and ANRA.

The NRSC SWOT analysis reflected the internal perspective of the national TSO and represented the principal organizational assessment of NRSC capabilities and future development needs. The analysis focused on organizational capabilities, technical expertise, management arrangements, competence development, knowledge preservation, research and development activities, resource sustainability and effectiveness of technical support functions (Figure 58).

Strength

Topic Nr.	Topic	Strength	Action Plan
4.1.01	4.1.01. Analysis and assessment of the current state of regulatory requirements.	NRSC as the main developer of the NEW Atomic Law for the country has a good command of legislative framework in the RA as the activity for development of new law was preceded by comprehensive review of the national regulations and international experience.	Enhancement of the capabilities in the area of development of regulations and improvement/revision of the draft law based on the results of the expertise to be conducted by the international experts (IAEA, EU, other).
4.1.02	4.1.02. Drafting of regulatory requirements, guidelines and recommendations.	NRSC as a TSO to the Regulatory Body has a good command of regulatory framework and the challenges existing in the field. Development of new regulatory documents and review/revision of existing regulations is conducted under annual contract with ANRA and other projects.	Continuous involvement of NRSC in the activities for development of national regulations covering different regulatory aspects on nuclear and radiation safety.

Weakness

Topic Nr.	Topic	Action Plan	Weakness
4.1	4.1. Support to the Development of Regulatory Documents.	Supplementing NRSC QMS with the process and procedure for development of regulatory documents.	NRSC, as a TSO, is actively involved in the development of regulatory documents. There is no process in the NRSC QMS for the development of regulatory documents.
4.1.02	4.1.02. Drafting of regulatory requirements, guidelines and recommendations.	Continuous investigation of the features and regulatory requirements for the new technologies, participation in knowledge sharing events.	NRSC as a TSO has a good command of all the aspects related to construction, commissioning and operation of larger nuclear reactors (WWER), but limited knowledge regarding new nuclear technologies like SMRs. There could be some difficulties in terms of knowledge and capacity when developing new regulations if SMR or other new technologies are selected as a new NPP design.

Opportunity

Topic Nr.	Topic	Opportunity	Capitalize
4.1	4.1. Support to the Development of Regulatory Documents.	The new EU project for ANRA/NRSC on approximation of national legislation with 5 EU directives will cover detailed review and gap analysis of the national regulations, identifying the gaps and improvement of national legislation framework (review of existing regulations, development of new regulations), as well as sharing with Armenia international experience on harmonization. NRSC is the main contributor to the gap analysis to be implemented and review/development of national regulations. This will enhance NRSC capacities in the area of review and development of national regulations.	Familiarization with international experience in approximation (harmonization) of national regulations with EU directives.

Threat

Topic Nr.	Topic	Threat	Prevent
4.1.02	4.1.02. Drafting of regulatory requirements, guidelines and recommendations.	Development of regulations needs active involvement of technical experts, high workload of the technical experts in other areas of their activities could make some delays in the development of documents.	Correct work planning, setting reasonable deadlines for the development of regulations.

Figure 58. Extract from the NRSC SWOT analysis

The ANRA SWOT analysis reflected the perspective of the Regulatory Body as the recipient of technical support and focused on the effectiveness, adequacy and responsiveness of the support provided by NRSC in carrying out regulatory functions (Figure 59).

Strength

Topic Nr.	Topic	Strength	Action Plan
1.2.01	1.2.01. Review of safety culture.	NSSC is very sensitive to ANS and the annual routine program planned relating to NPPs will be followed with observations of lessons-learned from events occurring in Russia and other countries.	Continue building of a safe functioning of NPPs staff in the annual contact with NPPs, tending to review performance in other stations.

Weakness

Topic Nr.	Topic	Action Plan	Weakness
1.4	1.4. Continue retention, attract and new staff/human brain.	Assure the rotation in the agency, and new staff of needs.	Identified attrition of a problem in the service, if remedials are not.

Opportunity

Topic Nr.	Topic	Opportunity	Capitalize
1.3.07	1.3.07. Presence of older workers.	Use the talent of and tap into retired NSSC staff as source of rich knowledge, of the courses of actions and safety culture.	Basically, their minds, mentoring and culture.
1.5	1.5. Knowledge Management.	Identify, build up a knowledge and knowledge sharing culture to strengthen and gain on the knowledge in the hands of NSSC, and to share.	Identifying a culture in NSSC and a Non-Quality Culture!
1.6	1.6. Communication and interaction.	To enhance public awareness and presence of the agency external to the nuclear safety and control (NPP), communicating knowledge, services, and role with regulatory framework by lectures, giving seminars, organising and communicating initiatives.	Enhancement of the interagency/corporate interaction with external stakeholders.

Threat

Topic Nr.	Topic	Threat	Prevent
1.6.04	1.6.04. Software Banking.	Malta issue to be faced, specialist skills gaps in some are in NSSC and can delay in procure required specialist due to: size of concern in the firm.	External skills in resource basis of available.

Figure 59. Extract from the ANRA SWOT analysis

Preparation of separate SWOT analyses provided an opportunity to compare organizational self-perceptions with the expectations and observations of the Regulatory Body. This comparison contributed to a more comprehensive understanding of strengths, weaknesses and development needs and supported identification of common themes affecting multiple assessment pillars.

The SWOT analyses were subsequently reviewed and validated during the National TOSCA Workshop and became one of the principal inputs to the independent IAEA assessment, development of findings and recommendations, preparation of organizational reports and formulation of Action Plans. They also provided an important basis for identifying cross-cutting issues affecting multiple assessment pillars.

In this way, the SWOT process represented a key analytical step linking assessment results with future capability development, strategic planning and continuous improvement activities.

5.9.6 Comparative analysis of assessment results

One of the most valuable outcomes of the Armenian implementation was the opportunity to compare the perspectives of NRSC, ANRA and the IAEA assessment team regarding the current status and future development needs of the national regulatory support framework.

The analysis demonstrated a remarkably high degree of consistency among the three perspectives. Although each participant evaluated the system from a different viewpoint, the majority of significant findings converged toward a common understanding of the key strengths, challenges and future priorities.

This convergence significantly increased confidence in the validity of the identified strategic development areas.

Human resources and competence development

The most consistently identified issue across all assessments was the long-term sustainability of human resources and technical competence (Figure 60).

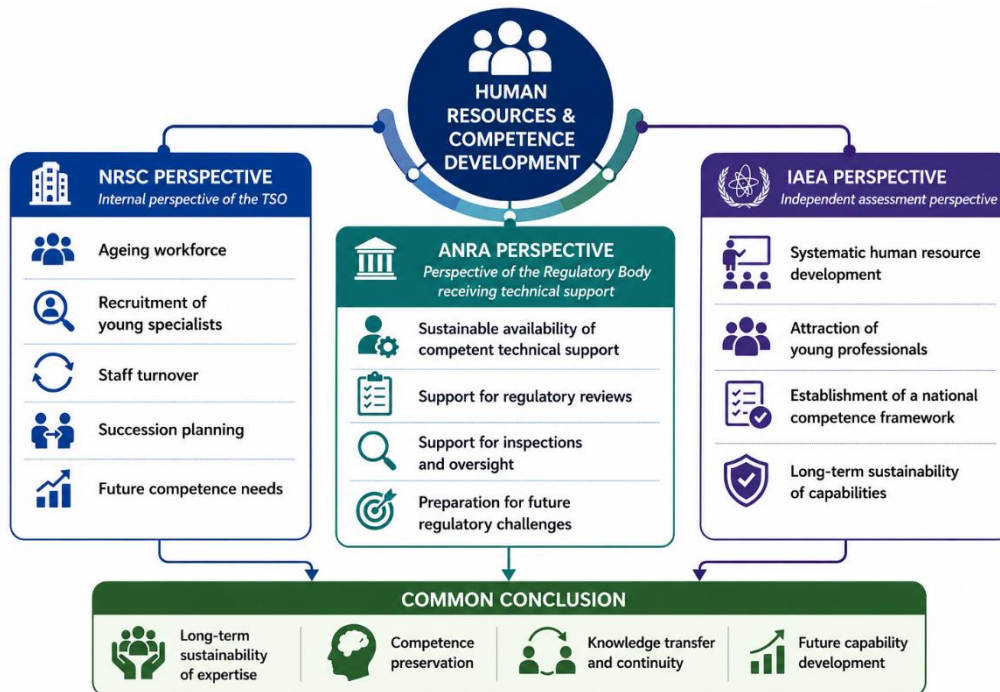


Figure 60. Comparative perspectives on human resources and competence development

NRSC identified challenges associated with:

- ageing workforce;
- recruitment of young specialists;
- staff turnover;
- succession planning;
- future competence needs.

ANRA emphasized the importance of ensuring continued availability of competent technical support for regulatory reviews, inspections and future regulatory challenges.

Similarly, the IAEA highlighted the need for systematic human resource development, attraction of young professionals and establishment of a national competence framework.

The assessment demonstrated that preservation and development of expertise represents the most significant long-term challenge facing the national regulatory support system.

National Radiation Laboratory

The establishment and operation of the National Radiation Laboratory emerged as another major development priority (Figure 61).

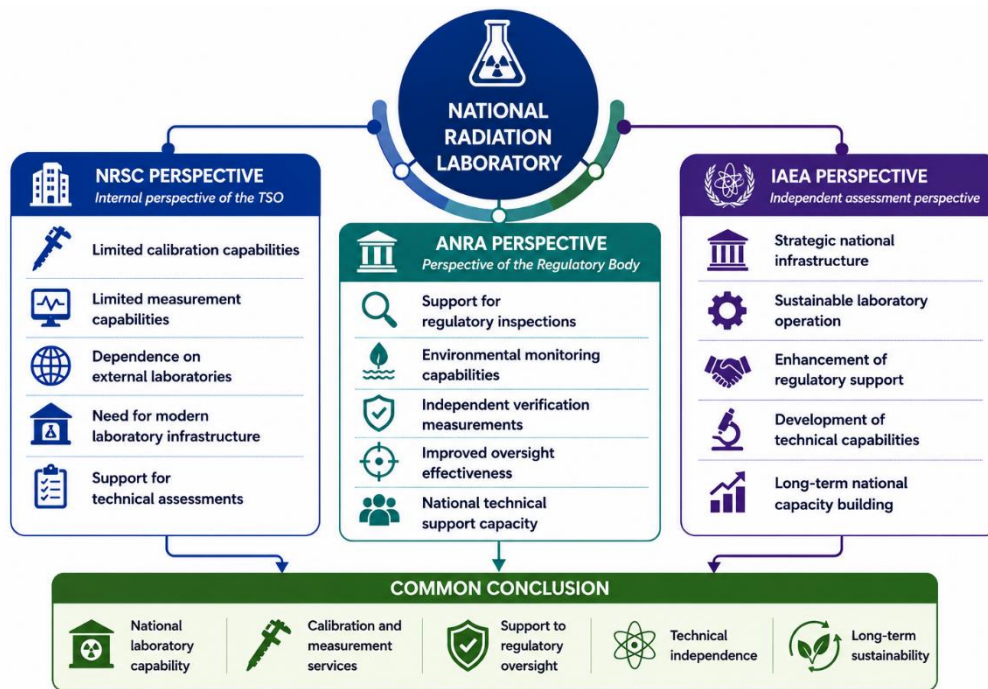


Figure 61. Comparative perspectives on development of the National Radiation Laboratory

NRSC identified limitations associated with the absence of operational calibration and measurement capabilities.

ANRA emphasized the importance of laboratory services for inspections, oversight and environmental monitoring.

The IAEA also identified the Radiation Laboratory as a strategic infrastructure element requiring priority attention.

The assessment demonstrated strong consensus regarding the importance of establishing sustainable national laboratory capabilities.

Future nuclear programme challenges

All assessment participants recognized the need to prepare for future challenges associated with:

- long-term operation of ANPP;
- future nuclear power programme development;
- radioactive waste management;
- decommissioning activities;
- advanced technologies and emerging regulatory issues.

The assessment confirmed that future preparedness, rather than current performance, represents the principal strategic challenge for the Armenian regulatory support framework.

5.9.7 Key conclusions from the self-assessment and SWOT analysis

The self-assessment and SWOT analysis demonstrated that NRSC is recognized as a competent and credible TSO capable of effectively supporting regulatory functions.

At the same time, the assessment identified several strategic development areas requiring continued attention, including:

- human resource and competence development;
- knowledge management and knowledge preservation;
- establishment and operation of the National Radiation Laboratory;
- sustainability of technical expertise;
- research and development capabilities;
- preparedness for future nuclear programme challenges;
- communication and stakeholder engagement;
- strengthening national and international cooperation.

The assessment further demonstrated that the principal challenge is not the adequacy of current capabilities, but rather their long-term sustainability.

The findings of the self-assessment and SWOT analyses subsequently became the primary input for the Action Planning process described in the following chapters.

5.10 Action plan preparation

The Action Planning chapter represented the final and concluding section of all TOSCA reports prepared during the Armenian implementation. While the preceding chapters documented assessment results, SWOT analyses, observations, IAEA recommendations and lessons learned, the Action Planning chapter transformed these findings into structured implementation measures and future development activities.

The Armenian implementation demonstrated that the ultimate objective of the TOSCA methodology is not the assessment itself, but the identification and implementation of improvements aimed at strengthening organizational capabilities, enhancing technical support functions and ensuring long-term sustainability. Consequently, the Action Plans constituted the principal output of the reporting process and the main mechanism for translating assessment results into practical organizational and national capability development activities.

5.10.1 Basis for Action planning

The Action Planning process was primarily based on two key inputs:

- SWOT analyses;
- IAEA findings and recommendations.

SWOT analyses were prepared separately by NRSC and ANRA following completion of the pillar assessments (see Subsection 5.9.5). They reflected the internal perspectives of the organizations and identified strengths, weaknesses, opportunities and threats based on self-assessment results, organizational experience and expert judgement.

In parallel, the IAEA expert team developed findings and recommendations based on review of assessment results, workshop discussions, submitted documentation, interviews, observations and comparison with international experience and good practices (see Section 5.8).

The Armenian implementation considered these two inputs to be complementary. SWOT analyses reflected organizational understanding of internal strengths, weaknesses and

development needs, while IAEA recommendations provided an independent external perspective on the same or related issues.

For this reason, Action Planning was not performed separately for SWOT analyses and IAEA recommendations. Instead, both inputs were consolidated and analyzed together. This approach enabled comparison and validation of findings from both organizational and international perspectives and ensured that the resulting actions reflected both internal needs and external expert recommendations.

5.10.2 Integration of SWOT results and IAEA recommendations

One of the most important methodological features of the Armenian implementation was the deliberate integration of organizational SWOT results with IAEA findings during preparation of the Action Plans (Figure 62).

This approach was applied for several reasons.



Figure 62. Integration of SWOT results and IAEA findings during development of Action Plans

First, the SWOT analyses and IAEA findings represented complementary perspectives. The SWOT analyses reflected the views of the organizations directly involved in regulatory and technical support activities, while IAEA findings provided an independent international expert perspective.

Second, a high degree of consistency was observed between the organizational SWOT results and IAEA findings. In both NRSC and ANRA assessments, similar strategic topics were identified, including:

- human resource development;
- competence management;
- knowledge preservation and transfer;
- communication and stakeholder interaction;

- sustainability of expertise;
- research and development;
- preparedness for future regulatory and technical challenges;
- continued organizational improvement.

This convergence increased confidence in the validity of the identified priorities and confirmed their strategic importance.

Third, integration was necessary to ensure that IAEA findings were fully used within the Organization Reports and Action Plans. If the Organization Report for NRSC and Organization Report for ANRA had been prepared only on the basis of self-assessment results and SWOT analyses, the IAEA findings would have remained a separate assessment product. In that case, some independent observations, particularly cross-cutting issues, might not have been sufficiently reflected in organizational conclusions, priorities and improvement actions.

To avoid this, Armenia applied an integrated approach in which applicable IAEA findings and recommendations were considered together with the organizational SWOT results during preparation of both Organization Reports and their Action Plans. This ensured that IAEA observations became an integral part of organizational assessment outcomes rather than remaining parallel external recommendations.

As a result, the Action Plans were not limited to isolated corrective actions. Improvement measures were grouped around broader strategic themes and capability development objectives, transforming the Action Planning process into a coordinated programme supporting long-term organizational sustainability and effectiveness.

5.10.3 Three-stage Action Planning process

Following the TOSCA methodology, the Armenian implementation applied the three-stage Action Planning approach incorporated within the TOSCA framework (Figure 63). This approach enabled large volumes of assessment information to be progressively transformed into strategic and implementation-oriented outputs, while maintaining traceability between initial findings and final actions.

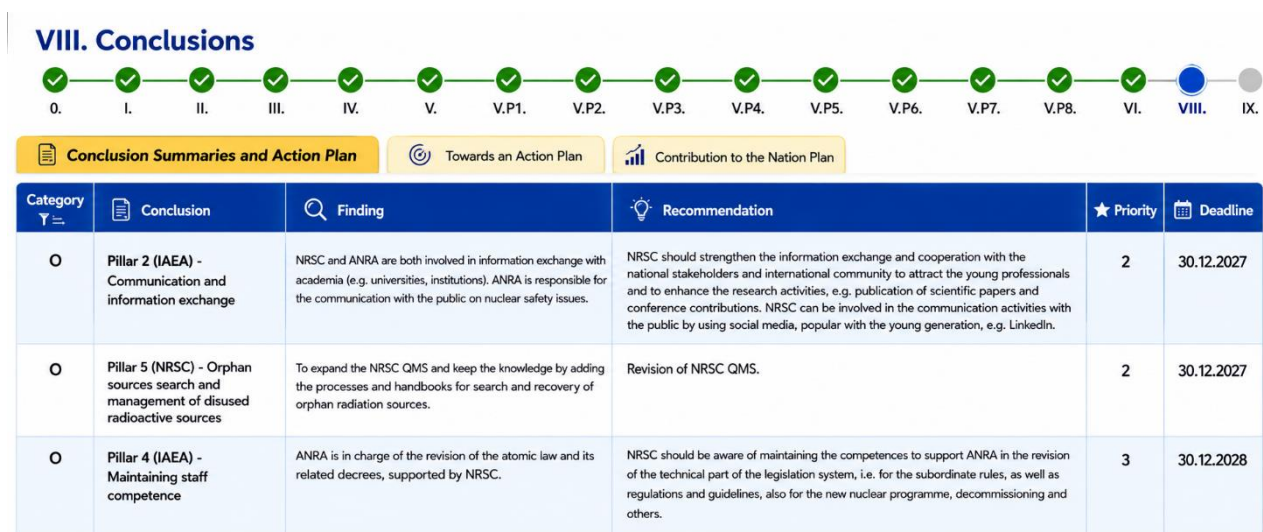


Figure 63. Three-stage transformation of assessment results into Action Plans

The transformation logic was as follows:

- 1) detailed assessment findings and observations;
- 2) consolidated thematic issues and conclusions;
- 3) strategic capability development directions and goals;
- 4) national development priorities;
- 5) implementation-oriented actions and tasks.

This approach helped reduce fragmentation, avoid duplication and ensure that overlapping findings were consolidated into coherent development priorities.

The schematic representation of the three-stage Action Planning process is presented in Figure 64.

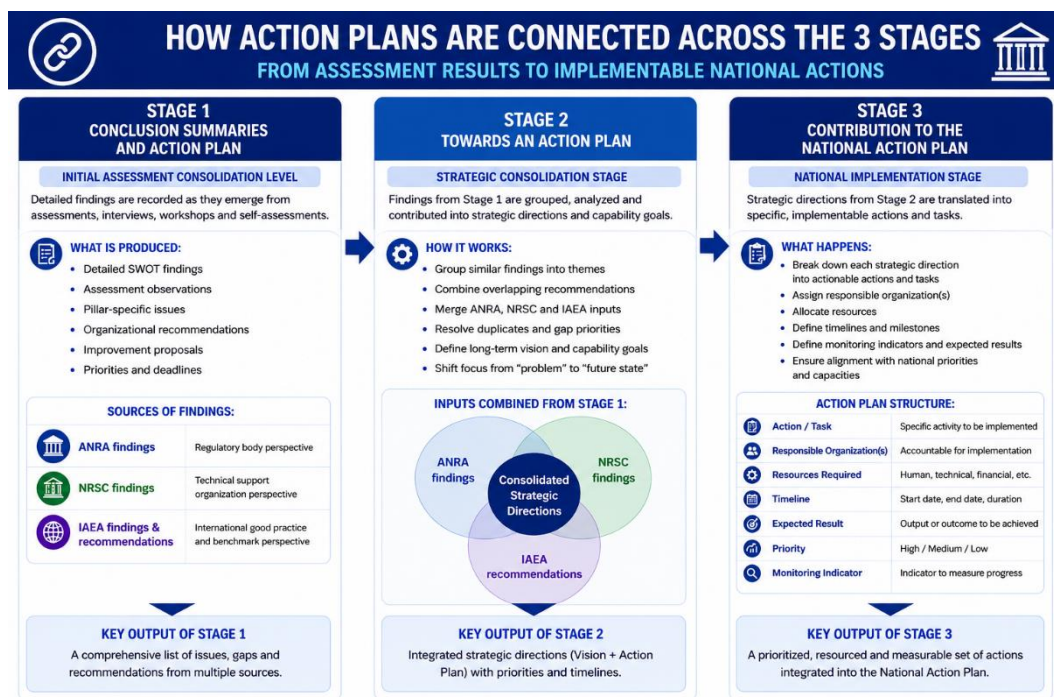


Figure 64. Three-stage Action Planning process

5.10.3.1 Stage 1 - Conclusion Summaries and Action Plan

The Conclusion Summaries and Action Plan stage represented the first and most detailed level of consolidation within the TOSCA Action Planning process. Its purpose was to collect, document and structure all findings identified during the assessment before they were further consolidated into strategic priorities and implementation actions.

This stage answered the question: “What exactly was identified during the assessment?”

At this stage, findings remained closely linked to their original source, assessment pillar and organizational perspective. This ensured traceability to the assessment results and prevented important findings from being lost during later consolidation.

Stage 1 consolidated inputs from three main sources:

- NRSC SWOT findings and observations;
- ANRA SWOT findings and observations;
- IAEA recommendations and observations.

The combination of inputs depended on the reporting level:

- NRSC Organization Report: NRSC SWOT findings and IAEA recommendations relevant to NRSC;

- ANRA Organization Report: ANRA SWOT findings and IAEA recommendations relevant to ANRA;
- National TOSCA Report: NRSC findings, ANRA findings and IAEA recommendations.

Each row in the Stage 1 table represented one identified issue, observation, opportunity, threat or recommendation (Figure 65 and Figure 66). The main columns included:

- S/W/O/T – type of issue identified;
- Conclusion – concise description of the issue or observation;
- Finding – detailed explanation and evidence;
- Recommendation – proposed corrective or improvement action;
- Priority – importance level;
- Deadline – implementation timeframe.

VIII. Conclusions

0. I. II. III. IV. V. V.P.1. V.P.2. V.P.3. V.P.4. V.P.5. V.P.6. V.P.7. V.P.8. VI. VIII. IX.

Conclusion Summaries and Action Plan Towards an Action Plan Contribution to the Nation Plan

Category 1	Conclusion	Finding	Recommendation	Priority	Deadline
0	Pillar 2 (AEA) - Communication and information exchange	NRSC and ANRA are both involved in information exchange with academia (e.g. universities, institutions), ANRA is responsible for the communication with the public on nuclear safety issues.	NRSC should strengthen the information exchange and cooperation with the national stakeholders and international community to attract the young professionals and to enhance the research activities, e.g. publication of scientific papers and conference contributions. NRSC can be involved in the communication activities with the public by using social media, popular with the young generation, e.g. LinkedIn.	2	30.12.2027
0	Pillar 5 (NSSC) - Orphan sources search and management of disused radioactive sources	To expand the NRSC QMS and keep the knowledge by adding the processes and handbooks for search and recovery of orphan radiation sources.	Revision of NRSC QMS.	2	30.12.2027

Figure 65. Action Plan stages – Conclusion Summaries and Action Plan

STAGE 1 CONCLUSION SUMMARIES AND ACTION PLAN
Initial Assessment Consolidation Level

MAIN PURPOSE
Collection of:

- Detailed SWOT findings
- Assessment observations
- Pillar-specific issues
- Organizational recommendations
- Improvement proposals
- Priorities and deadlines

CHARACTERISTICS

- Highly detailed
- Organization-specific
- Technically focused
- Directly linked to TOSCA pillars and SWOT entries

MAIN COLUMNS

Column	Meaning
S W O T	Type of issue identified
Conclusion	Concise description of the issue or observation
Finding	Detailed explanation and evidence of the issue
Recommendation	Proposed corrective/improvement action
Priority	Importance level
Deadline	Implementation timeframe

KEY FEATURE

- ANRA findings
- NRSC findings
- IAEA recommendations

STAGE 1 ANSWERS THE QUESTION:
"WHAT EXACTLY WAS IDENTIFIED DURING THE ASSESSMENT?"

Figure 66. Stage 1 – Conclusion Summaries and Action Plan

Stage 1 was not intended to produce final strategic priorities or implementation plans. Instead, it served as the detailed evidence base for Stage 2 – Towards an Action Plan, where similar findings were grouped, overlapping recommendations were consolidated, common themes were identified, and pillar-specific observations were transformed into broader strategic objectives and capability development directions.

Particular attention was given to findings that appeared in both NRSC and ANRA assessments, issues confirmed by IAEA recommendations, recurring challenges across several pillars, and development needs requiring coordinated actions.

5.10.3.2 Stage 2 - Towards an Action Plan

The Towards an Action Plan stage represented the second level of consolidation within the TOSCA Action Planning process. Its purpose was to transform the large number of detailed findings, observations and recommendations collected during Stage 1 into integrated strategic directions, capability development goals and long-term improvement priorities.

This stage answered the question: “What should the future organizational or national capability look like?”

While Stage 1 focused on documenting individual findings and recommendations, Stage 2 shifted the focus from specific problems toward desired future capabilities and strategic development directions. The objective was to identify common themes, eliminate duplication, consolidate overlapping recommendations and establish a coherent vision for future development.

The primary inputs to Stage 2 were the outputs generated during Stage 1, including:

- SWOT findings and observations;
- assessment conclusions;
- organizational recommendations;
- IAEA recommendations;
- identified priorities and deadlines.

The Armenian implementation demonstrated that many findings originating from different pillars and assessment perspectives were often related to the same underlying organizational challenge. Therefore, rather than addressing each finding separately, Stage 2 consolidated them into broader strategic capability goals.

Particular attention was given to:

- findings appearing across several pillars;
- common issues identified by both NRSC and ANRA;
- issues supported by IAEA recommendations;
- long-term sustainability challenges;
- capability gaps requiring coordinated organizational actions.

The consolidation process involved:

- grouping similar findings into common themes;
- combining overlapping recommendations;
- identifying root organizational causes;
- eliminating duplication;

- defining desired future capability states;
- transforming problem-oriented findings into development-oriented objectives.

Each row within the Stage 2 table represented a consolidated strategic development direction rather than an individual finding (Figure 67 and Figure 68). The principal columns included:

- Vision – desired future capability or organizational state;
- Action Plan – strategic direction required to achieve the vision;
- Priority – importance level;
- Deadline – target implementation timeframe.

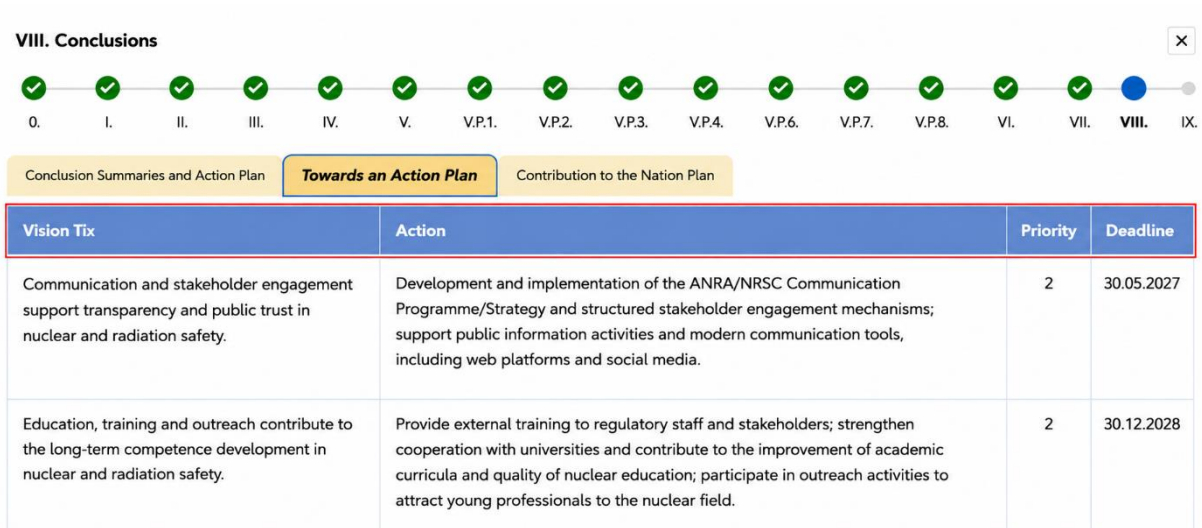


Figure 67. Action Plan stages – Towards an Action Plan

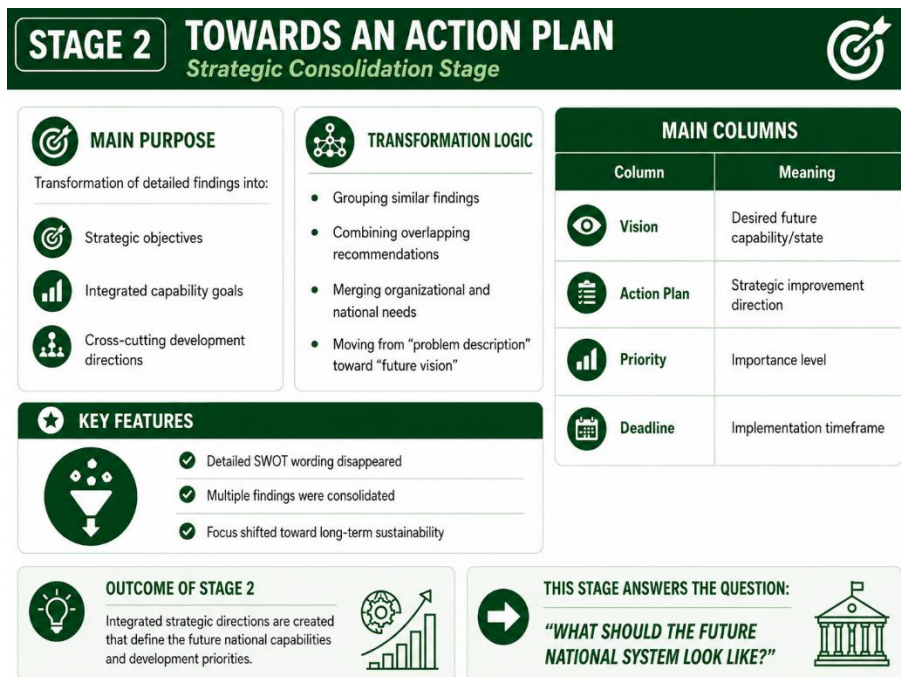


Figure 68. Stage 2 – Towards an Action Plan

Unlike Stage 1, detailed SWOT wording and individual recommendations were no longer presented separately. Instead, multiple findings were merged into integrated strategic objectives reflecting common organizational needs and development priorities.

The Armenian implementation demonstrated that Stage 2 significantly reduced the number of individual issues while preserving their substance and traceability. Every strategic direction developed during Stage 2 could be traced back to specific findings, SWOT elements and IAEA recommendations documented in Stage 1.

Several practical examples of this transformation were observed during the Armenian implementation.

One example concerned human resource development and competence sustainability (Figure 69), and includes the case from the NRSC Organization Report. Multiple findings identified in Pillar 1 - Role, Characteristics and Management, Pillar 2 - Capacity Building and Outreach and IAEA recommendations highlighted staff turnover risks, competence gaps, ageing workforce challenges, limited recruitment opportunities and the need for structured succession planning.

Rather than addressing each issue separately, these findings were consolidated into a single strategic vision - “Sustainable technical competence is ensured for current and future nuclear and radiation safety challenges and regulatory support functions”.

This vision was supported by a strategic Action Plan direction focused on development and implementation of a comprehensive Human Resource Development Programme covering recruitment, onboarding, mentoring, succession planning and competence management.

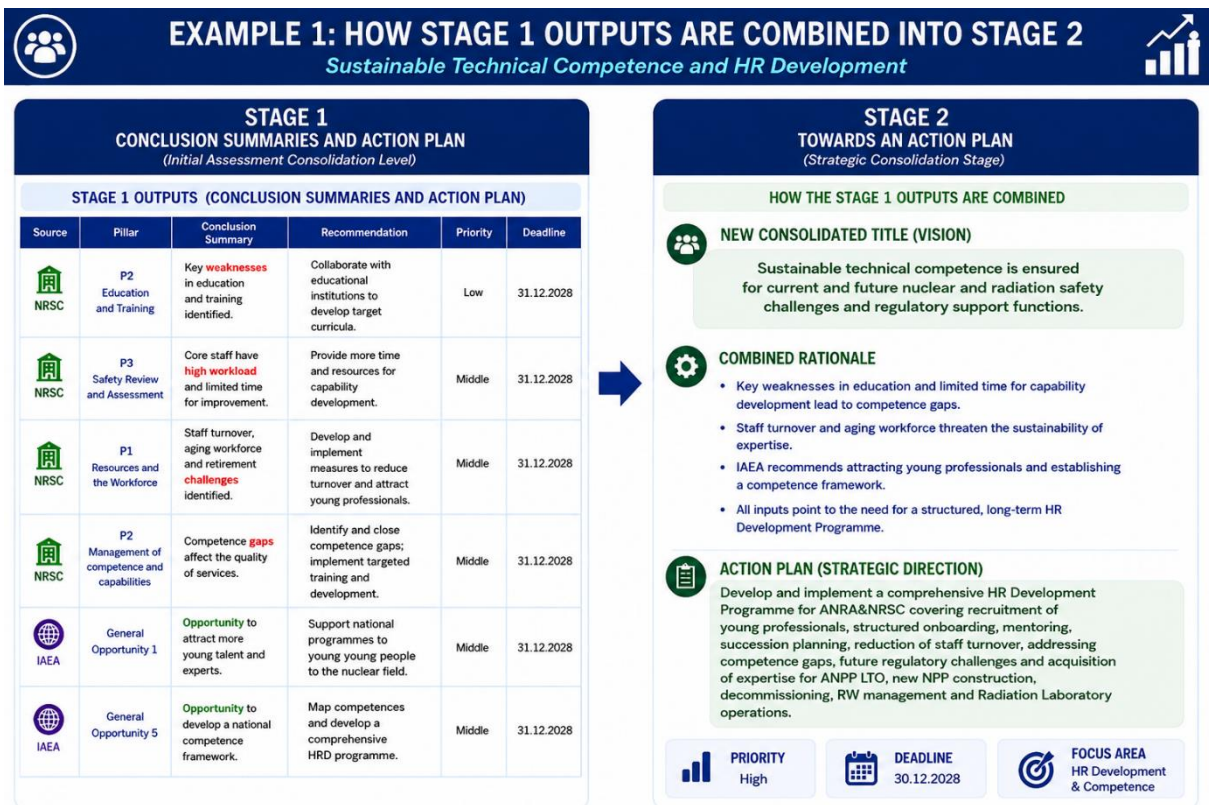


Figure 69. Combination of Stage 1 outputs into Stage 2 (example 1)

A second example concerned establishment of the National Radiation Laboratory (Figure 70). Several findings from Pillars 3 and 5, together with IAEA recommendations, identified the absence of national dosimetry calibration capability, insufficient laboratory infrastructure and limited support to oversight activities. These findings were consolidated into the strategic vision - “National Radiation Laboratory is fully operational.”

The corresponding Action Plan direction focused on establishment of laboratory infrastructure, procurement of equipment, development of methodologies and procedures, staff training and integration of laboratory functions into national oversight and emergency preparedness arrangements.

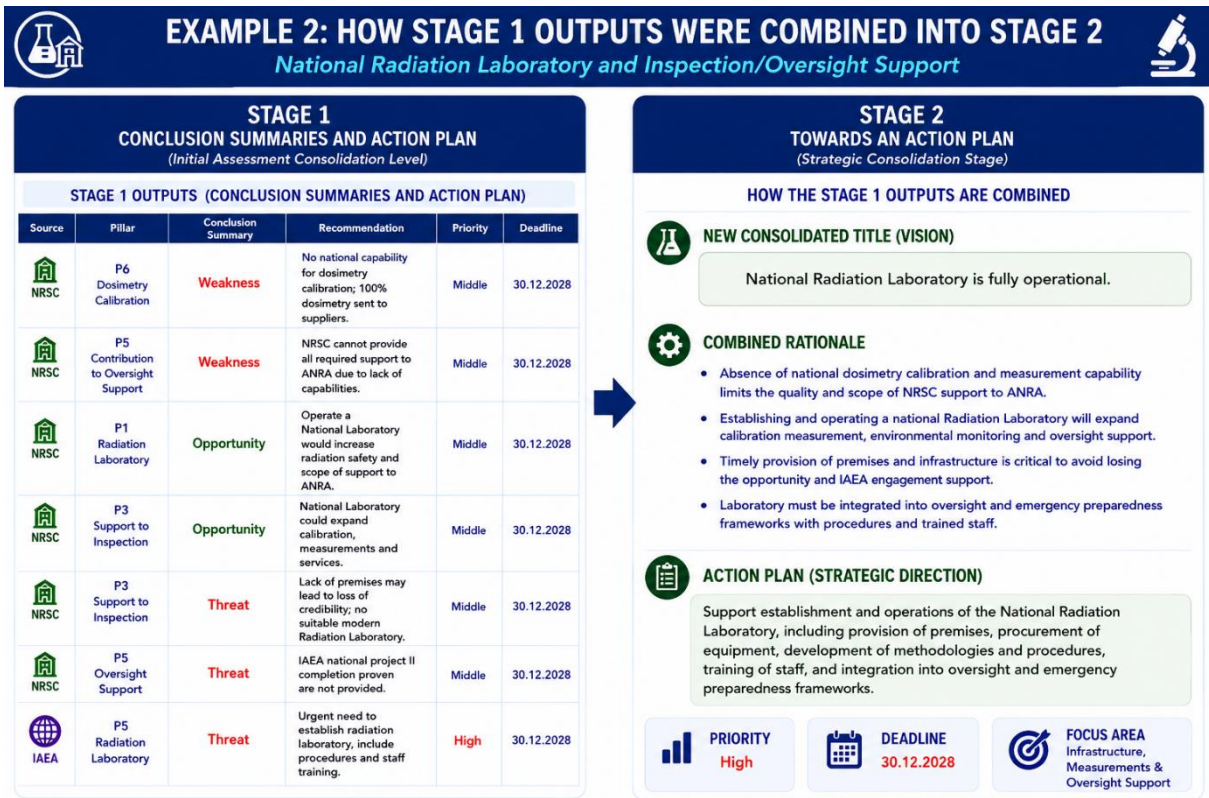


Figure 70. Combination of Stage 1 outputs into Stage 2 (example 2)

The Armenian implementation demonstrated that such consolidation significantly improved the manageability of the Action Planning process and facilitated identification of strategic priorities relevant to long-term organizational and national capability development.

The outputs of Stage 2 became the principal inputs to Stage 3 – Contribution to the National Action Plan, where strategic directions were further transformed into specific implementation actions, responsibilities, resources, performance indicators and measurable deliverables.

5.10.3.3 Stage 3 – Contribution to the National Action Plan

The Contribution to the National Action Plan stage represented the final level of consolidation within the TOSCA Action Planning process. Its purpose was to transform strategic capability development directions identified during Stage 2 into specific, measurable and implementable actions that could be incorporated into the National Action Plan.

This stage answered the question: “What will be done, who will do it, with what resources, by when, and how will progress be measured?”

While Stage 2 focused on defining strategic visions and capability development directions, Stage 3 translated those strategic intentions into practical implementation measures. The objective was to ensure that the assessment results were transformed into realistic actions capable of strengthening the long-term effectiveness and sustainability of the national regulatory support framework.

The primary inputs to Stage 3 were the outputs generated during Stage 2, including:

- strategic visions;
- capability development goals;
- Action Plan directions;
- implementation priorities;
- target completion dates.

The Armenian implementation demonstrated that Stage 3 required a shift from strategic thinking toward implementation planning. At this stage, multiple strategic directions were reviewed and, where appropriate, consolidated into a single implementation action in order to avoid duplication and ensure efficient use of resources.

Particular attention was given to:

- practical implementation feasibility;
- availability of resources;
- organizational responsibilities;
- national priorities;
- coordination between organizations;
- measurable implementation outcomes.

Each row within the Stage 3 table represented a specific implementation commitment contributing directly to achievement of one or more strategic objectives identified during Stage 2 (Figure 71 and Figure 72).

The principal columns included:

- Target – capability or result to be achieved;
- Planned Task – specific implementation activity;
- Priority – importance level;
- Deadline – target completion date;
- Focus Area – organizational or technical area addressed by the action.

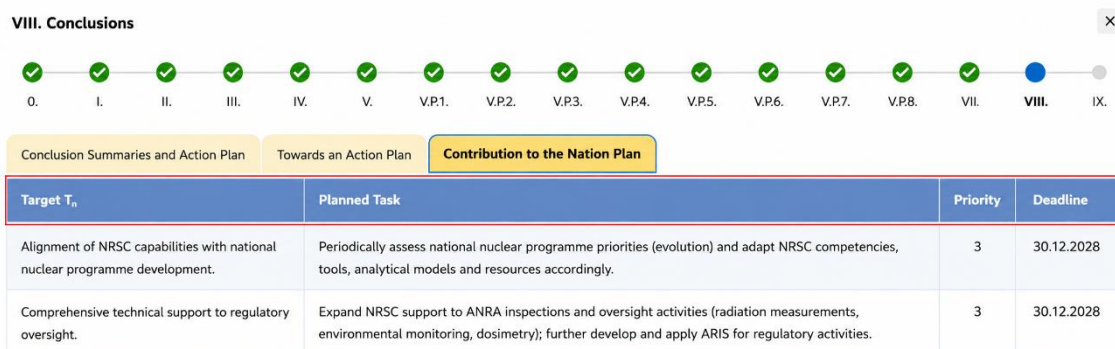


Figure 71. Action Plan stages – Contribution to the National Action Plan

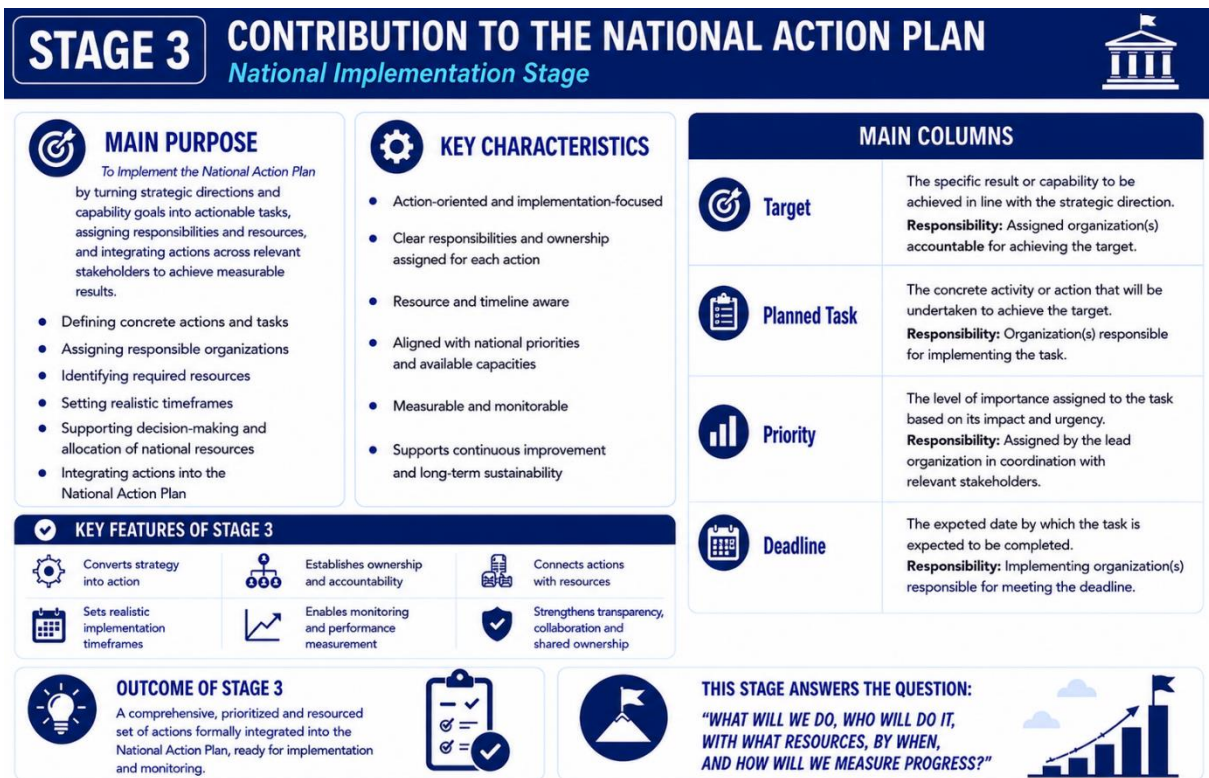


Figure 72. Stage 3 – Contribution to the National Action Plan

Unlike Stage 2, which focused on strategic development directions, Stage 3 defined concrete implementation activities, responsible organizations, required resources and expected results.

The Armenian implementation demonstrated that one of the main benefits of Stage 3 was the possibility to combine several related strategic directions into a single coordinated implementation activity.

For example, several strategic directions developed during Stage 2 related to (Figure 73):

- human resource development;
- education and training;
- competence sustainability;
- preparation for future nuclear programme challenges.

These directions were consolidated into a single implementation target focused on establishment of a comprehensive Human Resource Development Programme for ANRA and NRSC. The resulting implementation task included recruitment of young professionals, onboarding, mentoring, succession planning, competence gap closure and preparation for future regulatory challenges associated with ANPP LTO, new nuclear projects, decommissioning, radioactive waste management and operation of the National Radiation Laboratory.

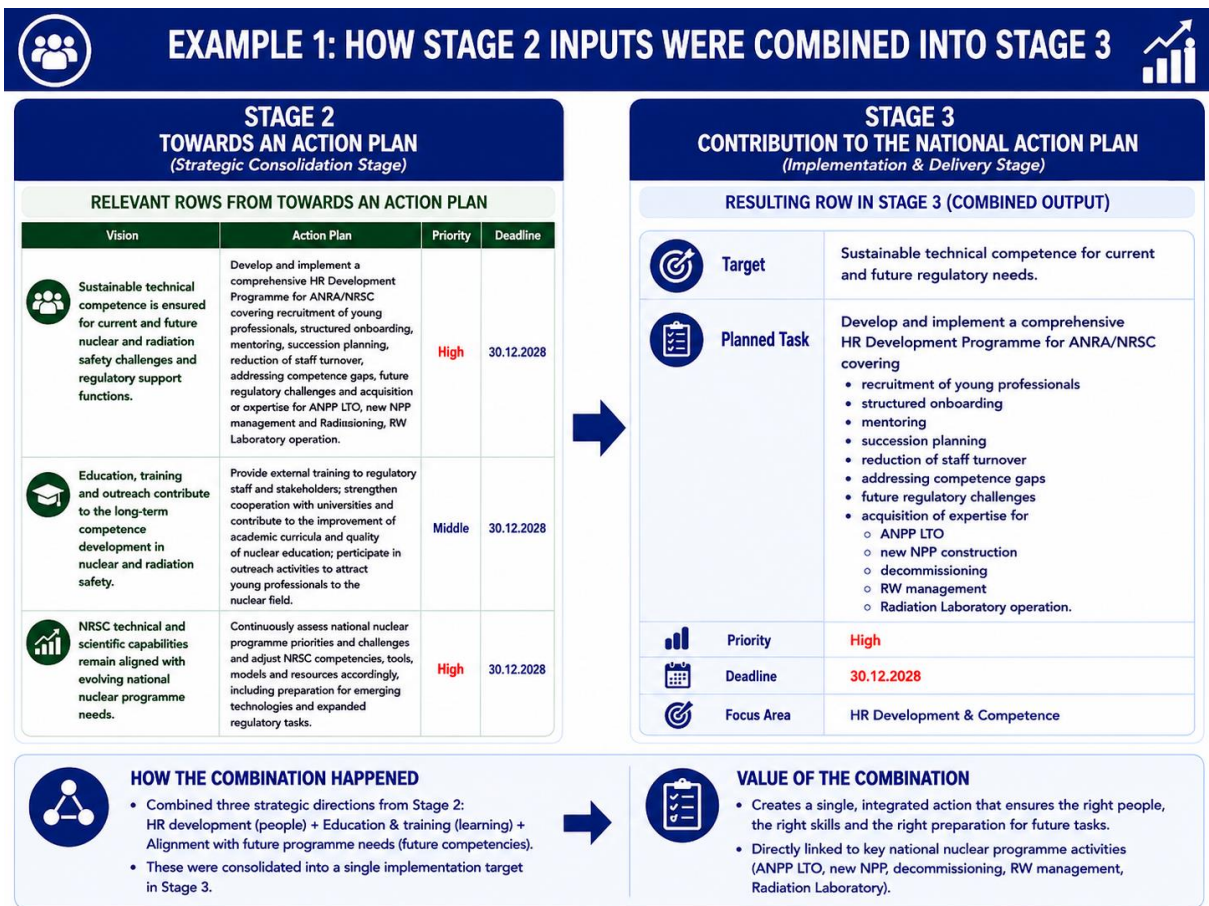


Figure 73. Combination of Stage 2 outputs into Stage 3 (example 1)

A second example concerned the establishment of the National Radiation Laboratory. During Stage 2, strategic directions addressed:

- establishment of laboratory infrastructure;
- development of calibration capabilities;
- strengthening regulatory oversight support;
- enhancement of emergency preparedness capabilities.

During Stage 3 these strategic directions were transformed into a single implementation target focused on establishment and operation of the National Radiation Laboratory (Figure 74). The planned task included provision of premises, procurement of equipment, development of methodologies and procedures, staff training, calibration services and integration of laboratory activities into regulatory oversight and emergency preparedness arrangements.

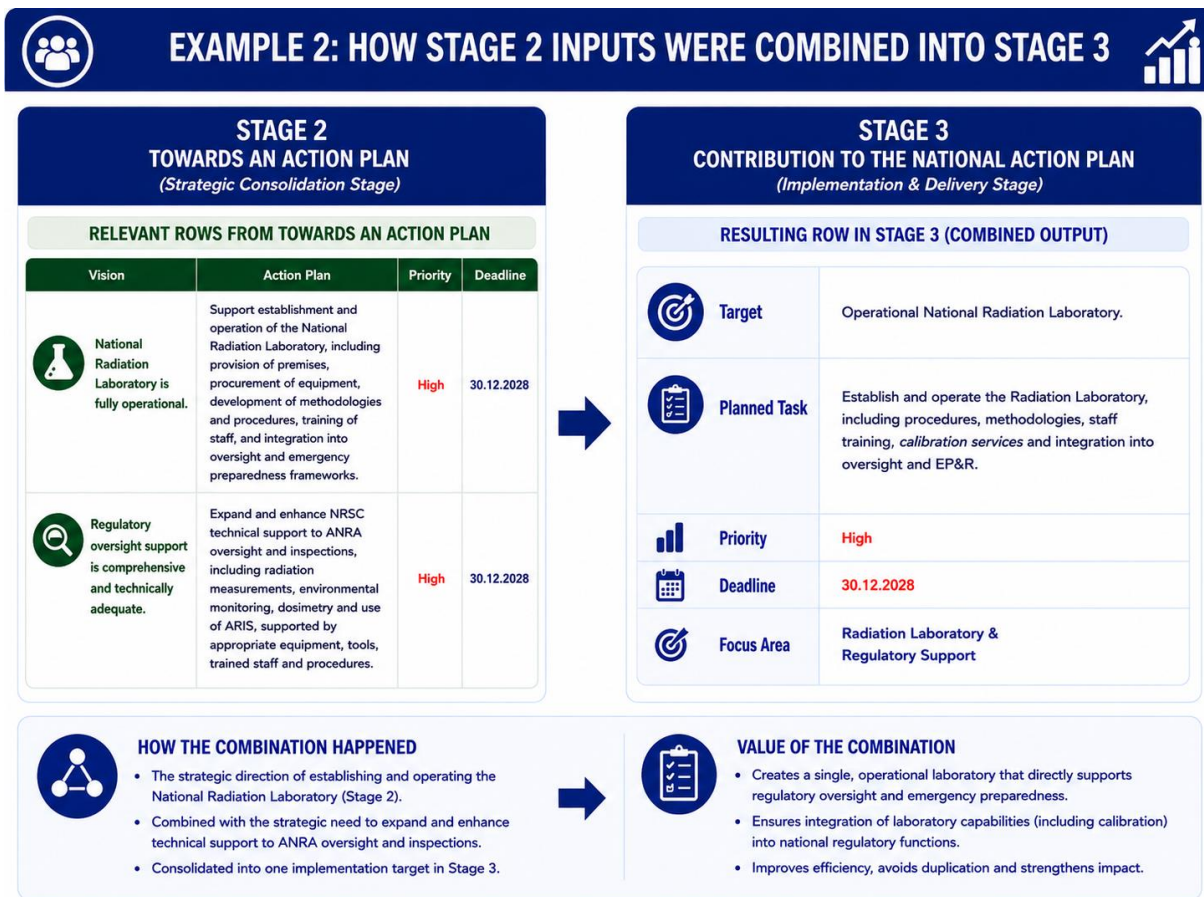


Figure 74. Combination of Stage 2 outputs into Stage 3 (example 2)

These examples demonstrated that Stage 3 does not simply transfer strategic directions into implementation tables. Instead, it performs an additional level of consolidation aimed at creating practical, coordinated and resource-efficient implementation actions.

The Armenian implementation demonstrated that this approach significantly improved manageability of the National Action Plan, reduced duplication of activities and strengthened coordination between organizations responsible for implementation.

The outputs of Stage 3 constituted the final Action Planning products of the TOSCA process and formed the basis for implementation, monitoring and follow-up activities. The resulting National Action Plan provided a structured framework for capability development, resource allocation and long-term improvement of the Armenian regulatory support infrastructure.

5.10.4 Final Action Plans, their relationship and implementation

The final output of the TOSCA assessment process was the development of Action Plans addressing the findings, recommendations and capability development needs identified during the assessment. The Action Plans represented the culmination of the three-stage Action Planning process and transformed assessment results into practical measures for strengthening the long-term effectiveness and sustainability of the Armenian regulatory support framework.

The outputs generated during Stage 3 - Contribution to the National Action Plan formed the basis for both organizational and national Action Plans. Separate Action Plans were

developed by NRSC and ANRA as final chapters of their respective Organization Reports, reflecting their specific roles, responsibilities and priorities.

An important feature of the Armenian approach was that relevant IAEA recommendations were already incorporated into the Organizational Action Plans. Therefore, the National Action Plan was not prepared by separately combining NRSC findings, ANRA findings and IAEA recommendations. Instead, it was developed through consolidation and harmonization of the NRSC and ANRA Action Plans, which already included applicable IAEA recommendations.

The NRSC Action Plan was based on NRSC SWOT findings and IAEA recommendations relevant to NRSC. It focused on strengthening NRSC's internal capabilities, technical expertise and sustainability of technical and scientific support functions, including competence development, knowledge preservation, R&D, communication, technical support capabilities, management processes, Radiation Laboratory activities, inspection support and emergency preparedness support.

The ANRA Action Plan was based on ANRA SWOT findings and IAEA recommendations relevant to the regulatory body's perspective on NRSC support. It did not represent an assessment of ANRA as an organization. Rather, it reflected ANRA's evaluation of the effectiveness, adequacy and sustainability of the technical and scientific support received from NRSC for implementation of regulatory functions. Accordingly, the Action Plan focused on strengthening ANRA-NRSC interfaces, clarifying future technical support needs, improving competence and knowledge transfer arrangements, enhancing communication and stakeholder engagement, supporting regulatory oversight through NRSC technical services, and ensuring preparedness for future regulatory challenges where sustained TSO support will be required.

The National TOSCA Action Plan represented the highest level of consolidation. It was developed through comparison, review and harmonization of the NRSC and ANRA Action Plans in order to identify common priorities, eliminate duplication, merge complementary actions and define coordinated national implementation measures. The resulting National TOSCA Action Plan is presented in Appendix C of this Case Study.

The National Action Plan therefore does not represent a simple aggregation of organizational actions. It reflects a coordinated national framework for capability development and improvement of the regulatory support system. Some actions appeared in both organizational plans and were transferred as common national priorities, such as human resource development, knowledge management, communication and stakeholder engagement, Radiation Laboratory operation, and emergency preparedness and response. Other actions addressed different aspects of the same strategic issue and were merged into single national objectives.

For example, the establishment and operation of the National Radiation Laboratory appeared in both organizational plans from different perspectives (Figure 75). In the NRSC Action Plan, it was linked to development of laboratory infrastructure, staff training, calibration services, radiation measurements and technical support to oversight. In the ANRA Action Plan, the same issue was reflected as a need to ensure effective use of NRSC technical services for inspections, measurements, monitoring and regulatory oversight. In the National Action Plan, these complementary actions were consolidated into a national objective on the Operational National Radiation Laboratory and comprehensive technical support to regulatory oversight.

Example: Establishment and Operation of the National Radiation Laboratory

The same strategic issue is addressed in both organizational plans from different perspectives and consolidated into a common national objective.



Figure 75. Harmonization of NRSC and ANRA priorities into a National Action Plan objective (example 1)

Another example is human resource and competence development (Figure 76). In the NRSC Action Plan, this was linked to recruitment of young professionals, onboarding, mentoring, succession planning, reduction of staff turnover and development of expertise for ANPP LTO, new NPP construction, decommissioning, radioactive waste management and Radiation Laboratory operation. In the ANRA Action Plan, it was reflected through competence needs assessment, targeted training and systematic knowledge transfer with NRSC support. In the National Action Plan, these inputs were consolidated into broader national objectives on the National competency framework and long-term availability of competent national expertise.

Example: Human Resource and Competence Development

The same strategic issue is addressed in both organizational plans from different perspectives and consolidated into common national objectives.

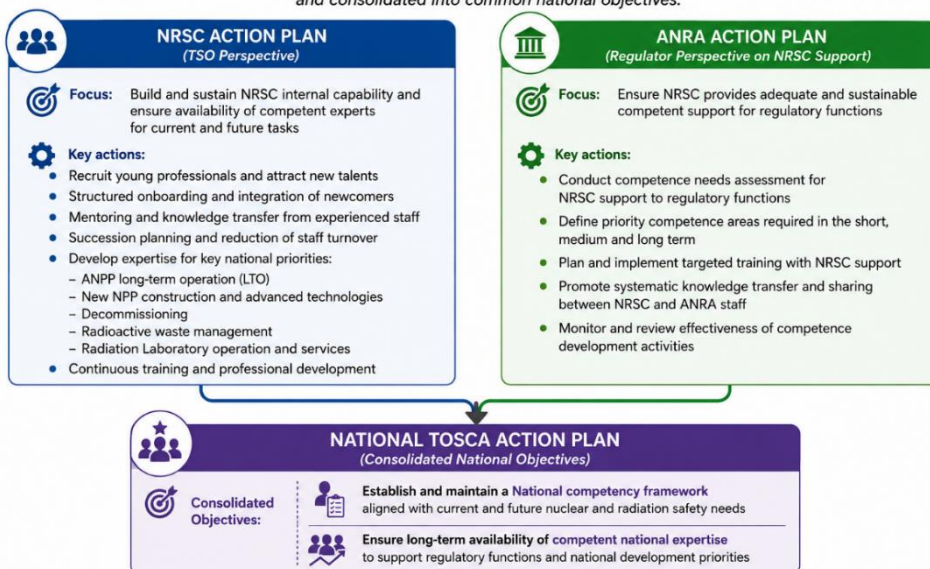


Figure 76. Harmonization of NRSC and ANRA priorities into a National Action Plan objective (example 2)

The resulting National Action Plan focused on strategic areas important for the future sustainability of the Armenian nuclear and radiation safety infrastructure, including human resource and competence development, knowledge transfer, communication, R&D, technical support functions, sustainability of expertise and infrastructure, preparedness for future nuclear and radiation safety challenges, and strengthening cooperation among ANRA, NRSC and other stakeholders.

Preparation of the Action Plans required consultation, review and validation by assessment participants, management and technical experts. At the time of preparation of this Case Study, formal validation and approval of the TOSCA reports and Action Plans had not yet been fully completed. Nevertheless, the identified priorities have already been used by NRSC and ANRA for organizational planning and capability development.

Several improvement actions have already entered implementation through internal initiatives and ongoing development programmes. Further activities are planned to continue using internal organizational resources, support from ANRA and NRSC management, national cooperation mechanisms, IAEA Technical Cooperation projects, bilateral and multilateral cooperation programmes, and support from international organizations and partner institutions.

The Armenian experience demonstrated that the main value of the TOSCA methodology lies in transforming assessment results into practical organizational and national development activities. In this respect, the National TOSCA Action Plan serves as the key implementation document for long-term capability development and continuous improvement of the Armenian regulatory support framework.

6. Case Study Library

An important supporting feature of the TOSCA online tool is the Case Study Library, which serves as a centralized repository for practical examples, lessons learned and implementation experiences from IAEA Member States and TSOs. The library is intended to facilitate knowledge sharing, exchange of experience and dissemination of good practices related to the establishment, development, operation and assessment of TSOs.

The Case Study Library complements the methodological and guidance documents available within the TOSCA platform by providing users with access to real-world examples illustrating how different organizations have addressed technical, organizational and strategic challenges associated with TSO development and operation.

The primary objectives of the Case Study Library are to:

- support organizational learning through practical examples;
- facilitate exchange of experience among TSOs, Regulatory Bodies and IAEA Member States;
- provide reference material for organizations considering implementation of the TOSCA methodology;
- demonstrate different approaches to development and operation of TSOs;
- share lessons learned, challenges and good practices;
- support continuous improvement of technical and scientific support capabilities;
- contribute to development of international TSO networks and cooperation.

The present Case Study describing the application of the TOSCA methodology in Armenia will also be included in the Case Study Library. As the first comprehensive national application of TOSCA involving parallel assessments by both the TSO and the Regulatory Body, an independent IAEA assessment, development of organizational and national reports, Action Planning activities and subsequent implementation initiatives, the Armenian experience provides a valuable practical example for organizations considering implementation of the methodology. Inclusion of this Case Study in the library will contribute to international knowledge sharing and support future users of the TOSCA methodology.

7. Next steps and continuous improvement

The TOSCA assessment represented an important milestone in the development of the Armenian TSO framework. However, the assessment itself was not considered the final objective. The principal value of the exercise lies in implementation of the improvement actions identified through the self-assessments, SWOT analyses and independent IAEA assessment, and in ensuring that the assessment results contribute to long-term strengthening of the national regulatory support infrastructure.

At the time of preparation of this Case Study, the NRSC Organization Report, ANRA Organization Report, National TOSCA Report and corresponding Action Plans had been completed and formally reviewed and validated by both NRSC and ANRA. The next stage of implementation focuses on review and validation of the assessment outputs by the IAEA, continued implementation of priority actions and monitoring of achieved results (Figure 77).



Figure 77. Next steps of TOSCA implementation in Armenia

IAEA review and validation

The immediate next step is submission of the finalized reports and Action Plans to the IAEA for review and validation.

The package will include:

- NRSC Organization Report, including Action Plan;
- ANRA Organization Report, including Action Plan;
- National TOSCA Report and National Action Plan.

The IAEA review will provide an additional independent verification of the assessment results, conclusions, recommendations and proposed improvement activities. Following completion of this process, the reports and Action Plans will serve as the principal reference documents for long-term implementation and monitoring activities.

Early implementation activities

Although the reports and Action Plans have not yet undergone formal IAEA validation, implementation of several priority activities has already commenced. This decision was taken due to the strategic importance of a number of development initiatives identified during the assessment and the recognition that preparation of key organizational programmes requires significant time and effort.

As a result, work has already started on several high-priority activities, including:

- development of a Strategic Development Programme for ANRA and NRSC aligned with the National Energy Sector Development Strategy;
- development of a Human Resource Development Programme addressing long-term competence development, succession planning and future staffing needs;
- development of a Communication Programme aimed at strengthening stakeholder engagement, public communication and outreach activities.

At the time of preparation of this Case Study, these initiatives had already achieved significant progress and are expected to provide the strategic framework necessary for implementation of many of the remaining actions identified through the TOSCA process.

Implementation strategy and prioritization

Implementation of the Action Plans will be based on a realistic and graded approach, taking into account available resources, organizational priorities and national needs. Each planned activity will be analysed to determine the most appropriate implementation mechanism, responsible organizations and required resources.

Depending on the nature of the activity, implementation may be achieved through:

- existing internal resources of NRSC and ANRA;
- ongoing or future international cooperation and technical assistance projects;
- governmental support where additional resources, infrastructure investments or policy decisions are required.

The Action Plans were intentionally developed with consideration of practical implementability, allowing progressive implementation of improvement measures within realistic organizational and national constraints. Particular attention was devoted to identifying actions that could realistically be implemented using existing capabilities while also creating opportunities for future expansion and development.

Long-term implementation

Following establishment of the strategic and programmatic framework, implementation will progressively address the remaining priorities identified in the National Action Plan.

These activities include enhancement of cooperation with universities and educational institutions, development of research and innovation capabilities, modernization and harmonization of the regulatory framework, strengthening of emergency preparedness and response arrangements, reinforcement of regulatory independence and confidentiality mechanisms, and establishment of sustainable arrangements supporting long-term technical and scientific support to regulatory functions.

Implementation will also support expansion of national research and development activities, increased participation in international cooperation programmes and

strengthening of national technical capabilities required to address future challenges associated with long-term operation of ANPP Unit 2, radioactive waste management, radiation safety activities and potential future nuclear technologies.

Several actions may identify broader national needs requiring involvement of organizations outside ANRA and NRSC. While development of national strategies and governmental policy documents is beyond the direct responsibilities of the Regulatory Body and its TSO, ANRA and NRSC may develop organizational programmes (e.g. Human Resource Development Programme), concepts and proposals within their areas of competence and submit them for consideration by the relevant governmental authorities. Where appropriate, successful organizational initiatives may subsequently serve as a basis for broader national implementation.

Monitoring, reporting and future reassessment

Implementation of the Action Plans will be monitored jointly by ANRA and NRSC through existing planning, management review and reporting processes. Periodic reviews will evaluate implementation progress, achievement of milestones and effectiveness of completed actions.

An important follow-up activity will be communication of implementation progress to the international TSO community through participation in IAEA TSO Forum activities and other international cooperation mechanisms. These activities will provide opportunities to present progress achieved, share lessons learned, exchange experience with other TSOs and obtain feedback on implemented improvements.

Depending on future organizational needs, regulatory developments and implementation progress, Armenia may also consider conducting a follow-up TOSCA assessment. Such reassessment would provide an opportunity to evaluate improvements achieved since the initial assessment, identify new capability development needs and update strategic priorities in response to evolving national nuclear and radiation safety challenges.

The implementation of the Action Plans, supported by continuous monitoring, international cooperation and potential future reassessment, provides a structured framework for sustainable development of the Armenian regulatory support infrastructure and for strengthening the effectiveness, resilience and long-term sustainability of technical and scientific support provided to the national regulatory body.

8. Feedback on TOSCA methodology

An important component of the Armenian implementation of the TOSCA methodology was the collection, consolidation and submission of feedback to the IAEA regarding practical application of the methodology, questionnaires, supporting guidance, online assessment tool and Action Planning process.

The objective of the feedback process was to identify opportunities for further improvement of the TOSCA methodology based on practical implementation experience gained during its first national application in Armenia.

Feedback was collected throughout all stages of implementation, including:

- participation in the IAEA Explanatory Workshop;
- Preparatory Mission activities;
- self-assessment and SWOT analysis;
- National TSO Workshop;
- preparation of organizational and national reports;
- development of Action Plans;
- review of the online assessment tool and supporting documentation.

Feedback was prepared separately by NRSC and ANRA, reflecting their respective roles and experience during the assessment process. NRSC feedback was included as a separate chapter in the NRSC Organization Report, while ANRA feedback was included as a separate chapter in the ANRA Organization Report. At the national level, both sets of feedback were consolidated and reflected in the National TOSCA Report. This approach preserved the individual perspectives of each organization while enabling preparation of a combined national feedback package for submission to the IAEA and consideration in future improvement of the TOSCA methodology and associated software tools.

Overall, the Armenian experience confirmed that the TOSCA methodology provides a comprehensive, structured and flexible framework for assessment of TSOs. Participants particularly appreciated the methodology's ability to support both organizational assessment and strategic capability development through a systematic and evidence-based approach.

It should be noted that the Armenian implementation was performed using *Release 1.0 of the TOSCA Online Assessment Tool*, which was the version available at the time of the assessment. The tool successfully supported questionnaire management, assessment activities, SWOT analyses, report generation and Action Planning. Practical implementation, however, also enabled users to identify several opportunities for further enhancement related to navigation, organization of assessment information, traceability between assessment results and Action Planning stages, reporting functionality, user guidance and overall usability of the platform.

The feedback collected during implementation identified two major categories of observations.

The first category consisted of positive findings confirming the strengths of the methodology. Participants noted that the methodology:

- comprehensively covers the principal functional areas of TSOs identified in IAEA TECDOC-1835;

- can be applied to organizations with different levels of maturity and development;
- provides flexibility in defining assessment scope, depth and orientation;
- supports evidence-based evaluation and transparent decision-making;
- enables participation of multiple experts and stakeholders;
- facilitates organizational learning and strategic planning;
- • provides a structured basis for development of improvement programmes and Action Plans.

The second category consisted of recommendations for further enhancement of the methodology and supporting tools. These recommendations were primarily related to:

- improving consistency and balance between assessment pillars;
- enhancing coverage of certain technical areas, particularly within radiation protection and safety of radioactive sources;
- harmonizing terminology and pillar titles;
- improving assessment of organizational resources;
- strengthening traceability between assessment results and Action Planning stages;
- improving usability of questionnaires and online assessment tools;
- providing additional user guidance, examples and training materials;
- improving explanation of the Action Planning methodology and its implementation logic;
- strengthening consistency between SWOT analyses, recommendations and Action Plan development processes.

Particular attention was devoted to improvement of the Action Planning component. Participants considered it one of the most valuable elements of the methodology, but identified a need for additional guidance explaining the relationship between the different Action Planning stages and the transformation of assessment findings into strategic and implementation-oriented actions.

A number of observations and recommendations related specifically to the TOSCA Online Assessment Tool were subsequently considered by the IAEA during further development of the software. As a result, an enhanced Release 2.0 became available following the Armenian and other Member States' implementation. The updated version incorporates several improvements aimed at enhancing usability, navigation, reporting functionality and support for Action Planning activities. This evolution of the software demonstrates the value of practical implementation experience and the importance of continuous improvement of both the methodology and its supporting tools.

The complete list of findings, observations and recommendations identified during the Armenian implementation is provided in Organization Reports and National TOSCA Reports.

Overall, the Armenian implementation confirmed the effectiveness of the TOSCA methodology and demonstrated the value of systematic feedback as a mechanism for its continuous improvement. The consolidated feedback submitted to the IAEA provides practical input for further refinement of the methodology, assessment tool, supporting guidance and future international application of TOSCA

9. Lessons learned from TOSCA application

An important outcome of the Armenian implementation of the TOSCA methodology was the identification of lessons learned derived from the practical application of the methodology, interaction between stakeholders, preparation of assessment reports, development of Action Plans and implementation of assessment activities. The lessons learned were collected throughout the entire project lifecycle and reflected the experience gained by NRSC, ANRA, the IAEA expert team and other participants involved in the assessment process.

The purpose of documenting lessons learned was not only to support future application of the TOSCA methodology in Armenia, but also to provide practical insights that may be useful for other countries considering implementation of TOSCA or similar organizational assessment approaches.

The Armenian experience demonstrated that TOSCA should be viewed as a strategic organizational development and continuous improvement process rather than a one-time assessment exercise. While completion of questionnaires, SWOT analyses and reports represents an important part of the methodology, the greatest value was obtained through structured discussions, organizational learning, identification of strategic priorities and transformation of assessment results into implementation-oriented actions.

One of the most important lessons learned concerned stakeholder involvement and coordination. The active participation of NRSC, ANRA and the IAEA expert team allowed different perspectives to be compared, findings to be validated and a more balanced understanding of the national regulatory support framework to be achieved. The assessment demonstrated that effective interaction between the Regulatory Body and the TSO significantly improves the quality and credibility of the assessment results.

The Armenian implementation also confirmed the value of a coordinated group-based assessment approach. Discussions among experts, management representatives and assessment participants helped harmonize interpretation of assessment criteria, improve consistency of scoring, reduce subjectivity and strengthen ownership of the results. The experience demonstrated that assessment activities should be supported by a dedicated working group and coordinated through designated focal points possessing practical knowledge and experience in the relevant technical areas.

Another important lesson learned was the necessity of maintaining clear traceability throughout the Action Planning process. The Armenian approach demonstrated that findings, SWOT analyses, IAEA recommendations and implementation actions must remain linked throughout all stages of Action Plan development. Maintaining this traceability significantly improved transparency, consistency and confidence in the resulting priorities and implementation measures.

The assessment further demonstrated the importance of integrating TOSCA outputs into existing management, quality and strategic planning systems. Long-term sustainability of improvement activities can only be achieved when assessment results, development priorities and Action Plan activities become part of normal organizational processes and management arrangements. Similarly, Action Plans should be treated as living documents that are periodically reviewed and updated to reflect implementation progress, changing priorities and emerging challenges.

Particular attention was drawn to the importance of competence management, knowledge preservation and sustainability of expertise. For countries with relatively small nuclear programmes and limited expert resources, long-term availability of qualified personnel represents one of the most critical success factors. The Armenian experience confirmed that human resource development, knowledge transfer, succession planning and retention of critical expertise must be treated as strategic priorities rather than purely operational activities.

The implementation also demonstrated that TOSCA assessments should be closely aligned with national regulatory priorities and future programme developments. In the Armenian case, particular importance was attached to supporting ANPP long-term operation, preparation for future nuclear projects, radioactive waste management, radiation safety activities and development of national technical capabilities. The assessment therefore served not only as an evaluation of current capabilities but also as a mechanism for identifying future national development needs.

Another important observation was the need for strong management commitment throughout the assessment and implementation process. Many of the identified improvement actions require allocation of resources, organizational changes, competence development programmes and long-term strategic decisions. Effective implementation therefore depends on active support and engagement from senior management of the participating organizations.

Overall, the Armenian experience confirmed that TOSCA can serve not only as a methodology for assessment of Technical and Scientific Support Organizations, but also as a mechanism for organizational learning, strategic planning, capability development and continuous improvement. The methodology proved particularly valuable for identifying future development needs, strengthening stakeholder cooperation and transforming assessment findings into practical organizational and national improvement activities.

The complete list of lessons learned, practical observations and recommendations identified during the Armenian implementation is provided in Appendix A of this Case Study. The Appendix contains the detailed lessons learned collected throughout the assessment process and may serve as a reference for future applications of the TOSCA methodology.

10. Conclusions

The application of the IAEA TOSCA methodology in Armenia represented the first comprehensive and systematic assessment of the Nuclear and Radiation Safety Center (NRSC) as a TSO supporting the Armenian Nuclear Regulatory Authority (ANRA). The implementation provided an opportunity not only to evaluate existing technical and organizational capabilities, but also to assess the long-term sustainability, adequacy and future readiness of the national regulatory support framework.

The Armenian experience demonstrated that TOSCA can be applied as much more than a self-assessment methodology. The implementation confirmed its value as a structured framework for organizational learning, strategic planning, capability development and continuous improvement. Through the combination of self-assessment, SWOT analysis, independent IAEA review and Action Planning, the methodology provided a systematic mechanism for identifying strengths, development needs and long-term priorities for both the TSO and the national regulatory infrastructure.

An important feature of the Armenian implementation was the application of three complementary assessment perspectives. NRSC evaluated its own internal capabilities, resources, competencies and sustainability as a TSO. ANRA assessed the adequacy, effectiveness and future suitability of the technical and scientific support received from NRSC for implementation of regulatory functions. The IAEA expert team provided an independent international perspective and identified strengths, observations and recommendations for future development. The combination of these perspectives enabled a comprehensive and balanced evaluation of the national regulatory support system.

The assessment results demonstrated a high degree of consistency between the findings of NRSC, ANRA and the IAEA expert team. All three perspectives recognized the importance of maintaining sustainable technical competence, strengthening human resource development, preserving organizational knowledge, enhancing cooperation mechanisms and ensuring preparedness for future regulatory challenges. At the same time, each perspective provided valuable additional insights reflecting its specific role within the national regulatory framework.

The independent review performed by the IAEA expert team confirmed the credibility, effectiveness and maturity of the Armenian TSO model. Particular recognition was given to the role of NRSC as a credible, independent and full-scope TSO, the strong cooperation between ANRA and NRSC, and the continuity of technical support provided to the Regulatory Body. The IAEA recommendations further highlighted strategic areas requiring continued attention, including human resource development, knowledge management, establishment of the National Radiation Laboratory, strengthening of research and development activities and preparation for future programme challenges.

The Armenian implementation also demonstrated the value of SWOT analysis as a mechanism for transforming detailed assessment results into strategic development priorities. The SWOT process facilitated consolidation of findings, identification of common themes and development of implementation-oriented actions. This process ultimately led to preparation of organizational Action Plans for NRSC and ANRA and to development of the National TOSCA Action Plan.

A notable feature of the Armenian approach was the structured three-stage Action Planning process, which ensured full traceability from assessment findings to implementation

actions. The process allowed detailed observations and recommendations to be progressively consolidated into strategic objectives and coordinated national priorities. The resulting National TOSCA Action Plan represents the highest level of consolidation and serves as a coordinated framework for future capability development of the national regulatory support infrastructure.

Although the formal validation process for the TOSCA reports and Action Plans was still ongoing at the time of preparation of this Case Study, the assessment results have already begun to influence organizational planning and development activities. Several initiatives identified during the assessment have entered the implementation phase, while additional actions are planned through internal organizational programmes, support from ANRA and NRSC management, IAEA Technical Cooperation projects and other international cooperation mechanisms.

The Armenian experience further demonstrated that successful implementation of TOSCA depends on active stakeholder involvement, management commitment, openness of the self-assessment process and effective coordination among participating organizations. The lessons learned and practical recommendations identified during implementation provide valuable guidance both for future reassessments in Armenia and for other IAEA Member States considering application of the methodology.

Overall, the application of TOSCA in Armenia confirmed that sustainable regulatory effectiveness depends not only on technical capabilities, but also on the long-term development of people, knowledge, infrastructure, organizational processes and cooperation mechanisms. The assessment demonstrated that systematic capability evaluation combined with strategic Action Planning can provide a powerful mechanism for strengthening national regulatory support systems and ensuring their readiness to address current and future nuclear and radiation safety challenges.

The Armenian implementation therefore represents not only a successful application of the TOSCA methodology, but also an important step in the continuous development of the national nuclear and radiation safety infrastructure. It provides a foundation for future capability development, supports long-term sustainability of technical expertise and contributes to strengthening the effectiveness of the national regulatory framework in support of nuclear and radiation safety.

Appendix A. Lessons learned and additional observations from the Armenian TOSCA implementation

No.	Theme	Remark	Priority
1	Integration with management systems	TOSCA results and Action Plan activities should be integrated into existing management, quality and strategic planning systems to ensure sustainability and institutional implementation.	Middle
2	Use of international cooperation and benchmarking	IAEA support, TSO networks and international benchmarking should be used strategically to support complex improvements and identify realistic development approaches.	Middle
3	Documentation of rationale	Justifications for scoring, findings and recommendations should be documented to improve transparency, traceability and future reassessment.	Middle
4	Repetition of TOSCA assessments	TOSCA should be viewed as a periodic self-improvement tool rather than a one-time exercise. Repeating the assessment, even partially, supports continuous improvement and monitoring of progress.	Middle
5	Managing expectations of stakeholders	Expectations of stakeholders regarding the scope, outcomes and pace of improvements should be managed proactively through communication and coordination.	Middle
6	Sustainability beyond the Action Plan period	Planning should consider sustainability beyond the formal Action Plan timeframe, especially for competence development, knowledge retention and technical capability maintenance.	High
7	Preparation for TOSCA assessment	Preparatory meetings should be held before the assessment to agree on scope, methodology, interpretation of criteria, roles, responsibilities and assessment logic.	High
8	Harmonization of TSO, Regulatory Body and IAEA inputs	Organizational findings and IAEA recommendations should be reviewed together, harmonized and consolidated to avoid duplication and contradictions.	High
9	Strategic rather than corrective planning	Action Plans should not only correct identified gaps, but also support long-term capability development, future programme needs and sustainability objectives.	High
10	Realistic prioritization and resources	Actions should be prioritized according to national importance, available resources and realistic implementation capacity.	High

No.	Theme	Remark	Priority
11	Ownership of implementation	Each Action Plan activity should have clear ownership assigned to a responsible organization, unit or role to ensure accountability and follow-up.	High
12	Monitoring and follow-up	Regular monitoring, internal review and, where appropriate, partial reassessment using the TOSCA tool should be established to evaluate progress.	High
13	Self-assessment culture	Successful TOSCA implementation requires openness, transparency and willingness to critically assess weaknesses and improvement areas.	High
14	Alignment with national nuclear programme	TOSCA outputs should be aligned with national priorities, including ANPP LTO, new nuclear projects, radioactive waste management, radiation safety, HRD and national infrastructure development needs.	High
15	Selection of pillar focal points	For each assessment area or pillar, it is important to appoint a focal point or key expert who has practical knowledge of the real situation in the specific field and can provide objective conclusions and realistic assessments.	High
16	Living Action Plan	Action Plans should be treated as living documents and updated periodically based on implementation progress, organizational changes and emerging priorities.	High
17	TOSCA working group and coordination	The assessment should be organized as a coordinated collective exercise, supported by a dedicated working group responsible for planning, coordination and consolidation activities.	High
18	National stakeholder involvement	Effective TOSCA implementation requires active involvement of the Regulatory Body, TSO and other relevant national stakeholders to ensure common understanding and coordinated implementation.	High
19	Clear roles and interfaces	Roles, responsibilities and interfaces between Regulatory Body and TSO should be clearly defined and understood before starting the assessment.	High
20	Consistency of assessment inputs	Questions, scoring criteria and interpretation of requirements should be applied consistently by all respondents, supported by internal coordination and guidance.	High

No.	Theme	Remark	Priority
21	Alignment with national regulatory priorities	The assessment and resulting Action Plan should be explicitly aligned with national regulatory priorities and anticipated programme developments.	High
22	Scope of Action Plan	The scope of the Action Plan should be clearly defined and limited to organizations directly involved in the assessment.	High
23	Linkage with other IAEA review services	Results of TOSCA assessments should be considered together with findings from other IAEA review services, such as IRRS, to ensure coherence and avoid duplication.	High
24	Sustainability of technical capabilities	Long-term sustainability of expertise, laboratories, analytical tools, software, databases and infrastructure should be included in capability development planning.	High
25	Management commitment	Senior management commitment is essential for allocating resources, supporting coordination and ensuring implementation of improvement activities.	High

Appendix B. IAEA findings

No.	Pillar / Area	Finding	Recommendation	Priority
1	General 1	NRSC is seen as a credible, independent full-scope TSO supporting ANRA in all its assigned responsibilities for its regulatory functions (Development Step 4, National Priority High) to achieve a high level of safety culture, dealing with Conflict of interest and by maintaining the open and collaborative environment	Ensure the sustainability of its services to ANRA, NRSC should attract more young talents and experts (also from national universities) via additional initiatives and programmes. National programme to attract young people for the new and current nuclear energy sector	High
2	General 2	Excellent understanding and cooperation between the whole nuclear safety stakeholders (ANRA, NRSC and other relevant national and international organisations)	Encourage continuous dialogue including more stakeholders like government, ministries, universities, research institutions, industry and the public.	Medium
3	General 3	National high priorities include different topics like <ul style="list-style-type: none"> • New nuclear power programme based on emerging technologies, like SMR etc. • Lifetime Extension (LTE) of Medzamor Unit 2 • Decommissioning • Radioactive waste management • Laboratory on environmental and radiation monitoring 	The sustainability of resources at the national level (including existing TSO) should be ensured and consideration should be given to maintaining and enhancing expertise. Programme on R&D to address and support all the mentioned topics should be established	High
4	General 4	Continuity of the technical support to ANRA is ensured on short-term through annual contracts	The sustainability of human and financial resources of NRSC to address the ongoing and future tasks for ANRA could be ensured by the decision-makers by long-term programmes and mid-term commitments (e.g. MoU between ANRA and NRSC with a 5-year-plan)	High
5	General 5	New nuclear power programme needs a revised technical competence framework in place	Map the necessary national competences according to the phases of the NPP taking into consideration the new technologies and the challenges of the new and existing Nuclear Power Programme and drafting the HRD plan for NRSC	High

No.	Pillar / Area	Finding	Recommendation	Priority
6	Pillar 1, Role, Ch.+Mgm	ANRA acknowledges the role of NRSC providing the necessary technical services; however, due to the limited resources there is a risk of decreasing involvement of the TSO in the support of the regulatory functions.	ANRA and NRSC should formulate their needs for addressing the future challenges and opportunities, which could be considered by the relevant governmental authorities in the national strategic plan for establishing and sustaining the new nuclear programme, decommissioning of existing NPP and radioactive waste management.	High
7	Pillar 2, Capacity Building and Outreach	NRSC is conducting relevant training of its own staff – including newcomers, as well as ANRA's and other organisations' staff.	NRSC should maintain the systematic approach for KM within the organisations and focus on the knowledge transfer especially to the newcomers, e.g. junior staff programme, mentoring, on-the-job-training. Support from international community to adapt best-practices for HR Development programmes (Competency framework and networking)	Medium
8	Pillar 2, Capacity Building and Outreach	NRSC and ANRA are both involved in information exchange with academia (e.g. universities, institutions) ANRA is responsible for the communication towards the public on nuclear safety issues.	NRSC should strengthen the information exchange and cooperation with the national stakeholders and international community to attract the young professionals and to enhance the research activities, e.g. publication of scientific papers and conference contributions. NRSC can be involved in the communication activities with the public by using social media, popular with the young generation, e.g. LinkedIn.	Medium
9	Pillar 7 EP&R	The ANRA is part of the EP&R on National Level and has responsibilities related to events with potential radioactive releases, supported by NRSC.	NRSC should continue providing support to ANRA for the appropriate performance of the established processes and procedures – i.e. knowledge transfer and competence training. Additional exercises could be performed on national level and participation in international drills is encouraged. The accountability of the EWRMS should be continuously ensured. The expansion of the EWRMS should be considered.	High

No.	Pillar / Area	Finding	Recommendation	Priority
10	Pillar 6 OPEX	Because of the suspension of the activities of the VVER-Forum in 2019, NRSC has to rely only on the national OPEX and the IAEA Databases.	Beside the information coming from the IAEA IRS Database, ANRA/NRSC could seek on bilateral cooperation basis for more detailed information whenever needed.	Low
11	Pillar 5 RP-RS	NRSC provides support to topics related to radiation protection and radiation safety, including to environmental radiation monitoring	There is an urgent need to further proceed with the establishment of a Radiation Laboratory and corresponding procedures and training of the staff	High
12	Pillar 4 Reg. Docs	ANRA is in charge of the revision of the atomic law and its related decrees, supported by NRSC	NRSC should be aware of maintaining the competences to support ANRA in the revision of the technical part of the legislation system, i.e. for the subordinate rules, as well as regulations and guidelines, also for the new nuclear programme, decommissioning and others	High
13	Pillar 3 Safety Assessm ent and Inspectio n	<p>Safety Assessment: NRSC provides the required support to ANRA for the current safety assessment tasks.</p> <p>NRSC relies on external support to fulfill its assigned safety assessment tasks for ANRA for specific topics, where there is a lack of expertise</p>	<p>Safety Assessment: With regard to the future national nuclear power strategy, NRSC should consider to ensure the availability of the required resources.</p>	Medium
			<p>The HR development program should focus also on acquiring the respective expertise for the future tasks/needs on safety assessment;</p>	High
			<p>NRSC is encouraged to participate in international networks, e.g. IAEA TSO Forum and other relevant thematic networks</p>	Medium
14	Pillar 3 Safety Assessm ent and Inspectio n	Inspection:	Inspection: NRSC should focus on expanding the scope of services for ANRA	High

No.	Pillar / Area	Finding	Recommendation	Priority
15	Pillar 8 R & D	NRSC is using a variety of state-of-the-art simulation codes (AC2, Melcor, RELAP, RiskSpetrum, MCNP etc.) and have the capability to do risk informed decision making.	Regarding the future national nuclear tasks, NRSC should consider the utilization of the codes, based on the needs and availability of the financial resources and expertise.	Medium
		NRSC has a lack of technical experts to address future nuclear safety assessment and R&D needs.	NRSC should consider to recruit and train the necessary experts in the specific R&D and nuclear safety assessment areas necessary for the ongoing and future activities and to work on the specific simulation codes.	High

Appendix C. National Action plan

No.	Target	Planned Task	Priority	Deadline
1	Regulatory document development fully embedded in management systems	Establish and implement a formal end-to-end process for development, review and revision of regulatory documents within NRSC QMS.	Low	30.12.2026
2	Systematic use of national and international operating experience	Strengthen mechanisms for collection and analysis of operating experience through increased contributions to IAEA IRS, active participation in international networks, bilateral cooperation and systematic dissemination of lessons learned.	Low	30.12.2028
3	Effective cooperation with academia and the education system	Improve university curricula in nuclear and radiation safety disciplines; provide external training and lecturing; align education outputs with national competency needs and attract young professionals to the sector.	Middle	30.12.2028
4	Long-term sustainability of national nuclear safety resources	Expand HRD and R&D programmes to national level, ensure long-term infrastructure solutions (premises, laboratories) and integrate nuclear safety capacity needs into national development strategies.	High	30.12.2028
5	Continuity and sustainability of technical and scientific support to regulatory functions	Develop and implement a 5-year Strategic Programme for ANRA with NRSC, aligned with the national Energy Sector Development Strategy; formalize long-term cooperation arrangements (e.g. multi-year MoU/programme) and secure stable governmental financing and institutional commitments.	High	30.12.2028
6	Modern and internationally aligned national nuclear and radiation safety regulatory framework	Revise and harmonize national legislation, regulations and guides (Atomic Law, subordinate acts, regulatory documents) in line with IAEA Safety Standards, IRRS recommendations and EU directives (CEPA), with coordinated involvement of ANRA and NRSC and participation in international projects.	High	30.12.2028
7	Transparent and proactive public communication and stakeholder engagement	Develop and implement ANRA/NRSC Communication Programme/Strategy on nuclear and radiation safety to increase public awareness of ANRA/NRSC activities, covering ANPP LTO, decommissioning, new NPP construction and RW management, and using official websites, social media, public events and outreach activities, media engagement and stakeholder dialogue to proactively increase public awareness, understanding and trust.	High	30.06.2027

No.	Target	Planned Task	Priority	Deadline
8	Independence, impartiality and confidentiality of regulatory processes ensured	Maintain independence of technical judgement, reinforce confidentiality arrangements (NDAs, access control) and ensure quality-assured, impartial technical outputs supporting regulatory decisions.	High	30.12.2028
9	Expanded national R&D and innovation capacity	Participate in international R&D projects and networks; introduce modern analytical tools and codes; organize structured knowledge-sharing events to disseminate R&D results.	High	30.12.2028
10	Strong governance and regulatory relevance of R&D activities	Develop and implement a coordinated national R&D Programme for regulatory support, with NRSC responsible for implementation; define topics and methodologies in advance, ensure use of verified input data and systematic uptake of results in regulatory decision-making.	High	30.12.2028
11	Effective and resilient emergency preparedness and response system	Revise and expand ERC procedures; ensure reliability, maintenance and expansion of EWRMS; enhance use of decision-support tools (JRODOS); revise Government Decree No. 553 and conduct regular national and international exercises.	High	30.12.2028