



## **Assuring Quality in Agricultural Statistics while Accelerating Innovation: FAO's Statistics and Data Quality Assurance Framework and Mechanism**

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### **Abstract**

In today's world, data and statistics are the backbone of decision-making, guiding the design of sound policies and targeted interventions, and enabling governments and the international community to act on evidence towards the achievement of development targets and goals. Building on FAO's core mandate to collect, analyze, interpret and disseminate information on nutrition, food and agriculture, the Organization has modernized its statistical quality assurance framework and governance infrastructure to keep pace with a rapidly evolving data ecosystem. This paper presents the evolution and implementation mechanisms of the FAO Statistics and Data Quality Assurance Framework (SDQAF), designed to safeguard statistical integrity in the complex landscape of agricultural statistics. Building on the first Statistics Quality Assurance Framework of 2014, the SDQAF extends FAO's quality principles to emerging data domains, addressing issues such as the use of non-traditional data sources, data confidentiality and the protection of intellectual property. The framework is structured around 16 core principles covering the enabling institutional environment, the implemented statistical processes and the produced statistical outputs, and is reinforced by robust governance and a dedicated Data Quality Unit. Through statistical standards, capacity development, quality assessments, user consultations and clearance procedures, the SDQAF operationalizes these quality principles across FAO's decentralized

statistical system, ensuring that innovation strengthens rather than undermines trust in official statistics on food and agriculture<sup>1</sup>.

**Keywords:** statistical quality; quality assurance framework; agricultural statistics; data governance; non-traditional data sources; metadata.

## 1. Introduction

Article I of the Food and Agriculture Organization of the United Nations Constitution requires the Organization to collect, analyze, interpret, and disseminate information relating to nutrition, food, and agriculture. To fulfill its mandate, FAO regularly compiles and disseminates data and statistics which play a critical role in designing and targeting policies to reduce hunger, malnutrition and rural poverty, improve food systems' productivity, sustainability and resilience, and combat climate change, biodiversity loss and inequality. Moreover, as a custodian agency for 22 SDG indicators, FAO contributes directly to the assessment of progress towards the Sustainable Development Goals and operates globally as a key institution of the International Statistical System.

Building on this longstanding responsibility, FAO has for many years engaged in a sustained reflection on the concept of statistical quality and its dimensions. Ensuring that FAO's data and statistics remain relevant and fit for purpose requires not only accuracy and reliability, but also coherence and comparability across geographical areas and over time. Equally essential are accessibility and clarity, as well as timeliness and punctuality, to make data effectively usable by a diverse range of stakeholders. This multifaceted understanding of quality directly informs the procedures, standards and governance arrangements underpinning FAO's statistical production, guiding efforts to achieve the highest possible quality of statistical and data outputs.

A major milestone in this long-established commitment was reached in 2014 with the development and adoption of the first Statistics Quality Assurance Framework [1], which provided a structured and organization-wide foundation for the quality assurance activities and procedures that followed. Since then, however, the rapid technological change and the transformation of data ecosystems have reshaped the traditional modes of statistical production, expanding the range of available data sources, and enabling more direct access to data. For example, the growing availability of administrative records, geospatial information, and other non-traditional data sources presents opportunities to enhance timeliness, increase geographic granularity and produce statistics at more detailed levels of disaggregation, while reducing the burden on traditional data providers. These developments have also introduced new risks and challenges that must be carefully managed, related to the trustworthiness of data sources, sustainability of access modalities and conditions, privacy protection, and methodological soundness and reproducibility.

Against this background, in 2023 FAO further strengthened its statistical governance and quality assurance mechanisms through the adoption of the [Statistics and Data Quality Assurance Framework \(SDQAF\)](#) [2], which replaces and supersedes the SQAF. The SDQAF extends FAO's approach to quality in response to an increasingly complex and rapidly evolving data ecosystem. While the SQAF provided a robust foundation for assuring the quality of traditional statistical outputs, the SDQAF broadens the scope from statistics alone to encompass data more generally, including the use of non-traditional and integrated data sources. In doing so, it maintains continuity with the core quality dimensions established under the SQAF, while introducing a more explicit focus on governance, risk management, and transparency throughout the data lifecycle.

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<sup>1</sup> The authors confirm that the text and materials contained in this manuscript are free from any copyright violations.

This paper examines the quality challenges inherent in FAO's statistical function and presents the structure and implementation mechanisms of the SDQAF. It describes how FAO has operationalized quality principles through governance arrangements, statistical standards and assessment procedures to evaluate adherence of statistical and data outputs, as well as production processes, to the SDQAF.

## **2. Quality Challenges in FAO Statistical System**

Several structural challenges make the production of high-quality agricultural statistics a complex endeavor for FAO.

Most of the statistical outputs disseminated by the Organization are compiled from secondary data provided by national statistical authorities, which are then processed to ensure internal coherence and international comparability. In this context, FAO does not have direct control over the accuracy and reliability of the underlying statistics but can act only indirectly through provision of capacity development and technical assistance at the national level. In addition, the Organization does not always have complete visibility into the survey designs, estimation procedures, revision policies or methodologies adopted by countries, as - even when data are reported through standardized questionnaires - identical labels may mask heterogeneous measurement practices. For instance, crop production data may be derived from agricultural sample surveys, administrative reporting systems, agricultural censuses, or combinations of these and other methods. It is therefore necessary to strike a balance between minimizing the reporting burden on data providers, and collecting sufficiently detailed metadata at the national level, to determine whether observed differences across countries reflect real phenomena or are simply the result of discrepancies in adopted measurement approaches and methodologies.

These challenges are further compounded by the scale and decentralized nature of FAO's statistical system. Multiple technical units across the Organization are responsible for producing thematic datasets within their respective areas of expertise, under the overall leadership and coordination of the FAO Chief Statistician. While decentralization is essential to ensure subject-matter depth and technical relevance, it also introduces risks of inconsistency in statistical production processes, documentation practices and dissemination standards. Quality assurance must therefore operate both vertically, within individual statistical processes, and horizontally, across domains and organizational units, to ensure coherent and consistent application of quality principles.

Finally, statistical innovation introduces a further layer of complexity. The increasing use of non-traditional data sources, such as remote sensing products, geospatial data and other forms of big data, offers significant potential but also presents specific challenges. These data sources are often not designed for statistical purposes, may be subject to methodological changes over time, and may raise legal, ethical or access-related constraints.

In this context, the adoption of the SDQAF provides the architecture needed to manage these diverse risks, ensuring that innovation strengthens, rather than compromises, the integrity and credibility of FAO's statistical and data outputs.

## **3. The FAO Statistics and Data Quality Assurance Framework (SDQAF)**

The Statistics and Data Quality Assurance Framework (SDQAF), adopted by FAO in 2023, is structured around sixteen core principles organized into three interrelated layers of quality management.

- **Principles 1 to 7 address the enabling institutional environment.** They cover professional independence and impartiality, continuous commitment to quality, adequacy

of resources, data protection and confidentiality, the development and use of international standards, and cooperation with data providers and cooperation with other international organizations.

- **Principles 8 to 11 govern statistical processes.** They focus on the suitability and trustworthiness of data sources, the soundness of methodologies, the cost-effectiveness of approaches, and the avoidance of excessive burden on respondents.
- **Principles 12 to 16 relate to statistical and data outputs.** They correspond to the fundamental quality dimensions of relevance, accuracy and reliability, timeliness and punctuality, coherence and comparability, and accessibility and clarity.

The SDQAF applies to all activities involved in the production of statistics or data for statistics carried out within FAO's decentralized statistical system. This covers the full statistical lifecycle - from data acquisition, validation and processing to documentation and dissemination - regardless of whether the data originates from statistical surveys, censuses, administrative systems or other external sources. The framework does not apply to FAO's internal administrative or operational data (e.g., human resources, finance, ICT systems, project implementation), nor to data collected solely for project monitoring and evaluation when these are not intended for dissemination as official FAO statistical outputs. A summary of the overall vision, principles, quality dimensions, and compliance mechanisms of the SDQAF is provided in the Annex through Figure 1.

#### **4. The SDQAF implementation modalities**

The SDQAF is operationalized through a structured set of mechanisms that translate quality principles into routine practices. These mechanisms reflect the three layers of the framework: institutional principles are implemented through governance, coordination and a well-defined accountability framework; process principles through corporate standards and policies; and output principles through quality assessments and engagement with data providers and external users.

##### **4.1 Effective governance, coordination and accountability**

The SDQAF is supported by governance arrangements designed to coordinate FAO's decentralized statistical system. The Chief Statistician provides corporate oversight and ensures adherence to statistical standards and quality principles. Strategic coordination is ensured through a Data Coordination Group (DCG), chaired by FAO's Chief Economist as Executive Data Champion and composed of the Directors of most FAO Divisions engaged in the production of statistics and data for statistics. The DCG endorses internal policies and standards, sets strategic priorities, and ensures coherence with FAO corporate-wide objectives, data policies and United Nations system-wide initiatives. It is supported by a technical arm, the Technical Data Coordination Group (DCG-T), chaired by the Chief Statistician, which operates through plenary meetings and thematic task forces to address cross-cutting coordination, methodological, classification, and quality management issues. To strengthen this architecture, FAO established a dedicated Data Quality Unit (DQU) in 2024 within its Statistics Division. The Unit is responsible for maintaining the SDQAF and related corporate standards, coordinating quality assessments and peer reviews, monitoring compliance with and supporting technical units in implementing quality procedures.

Accountability is operationalized through corporate clearance procedures, whereby the Chief Statistician – supported by the DQU – provides corporate clearance for FAO statistical activities and data products. All new statistical activities, projects with substantial data or statistical components, and dissemination platforms undergo early methodological and governance review

to ensure coordination, avoid duplication and promote coherence. These clearance procedures assess relevance, methodological soundness, cost-effectiveness, alignment with existing initiatives, and compliance with SDQAF principles and corporate standards.

For instance, questionnaires used for data collection are reviewed by the DQU and cleared by the Chief Statistician before each round, ensuring alignment with standards and minimizing unnecessary reporting burden on countries, consistent with SDQAF Principle 11 (Non excessive burden on respondents). Dashboards and other dissemination platforms undergo a two-stage review process. At the design stage, coherence with existing products and avoidance of duplication are assessed. At the dissemination stage, compliance with statistical standards, metadata requirements and communication policies is verified, reinforcing Principles 12 to 16 on output quality.

#### 4.2 Clear statistical standards covering the statistics lifecycle

FAO has developed and endorsed a series of Statistical Standards<sup>2</sup> which translate the quality principles outlined in the SDQAF into operational guidance for consistent implementation across the broad portfolio of the Organization's statistical activities. The promotion of these standards aims to harmonize practices and strengthen standardization across units by specifying recommended approaches and documentation requirements. Each standard defines its scope of applicability, provides general and technical recommendations, clarifies governance responsibilities and, where necessary, includes detailed implementation guidance. The development and revision of standards follow a coordinated process involving relevant technical experts and the DQU, and leading to endorsement by the DCG. In particular, the periodic revision of standards ensures that emerging areas of innovation are fully integrated into operational guidance.

Statistical Standards are designed to cover the full range of steps involved in producing statistical and data products, spanning data collection/acquisition, processing, validation, analysis and dissemination, so that quality requirements are embedded across the entire lifecycle.

FAO's statistical standards can be broadly grouped into the following categories:

- **Standards for data collection and acquisition:** These include the Handbook for designing survey questionnaires; standards on designing and dispatching questionnaires aimed at collecting secondary data from national institutions; and standards on the use of external data sources (i.e. statistics produced by other International Organizations) and on the acquisition and use of non-statistical data sources (i.e. big data and administrative records).
- **Standards for processing:** These focus on data treatment, processing and analysis, and comprise standards on data editing and validation; imputation; and aggregation. These documents provide methodological and procedural guidance for validating input data, handling outliers and missing data, and compiling statistical aggregates (e.g. at the regional and global levels).
- **Standards for dissemination:** This collection includes statistical standards for the dissemination of different statistical and data products. Concerning the dissemination of datasets of statistical indicators, FAO has developed standards on the compilation of SDMX compliant structural (units of measure and observation status codes) and reference metadata. In addition, a statistical standard for managing data revisions and another on producing quality indicators for external users is available. Regarding the dissemination of survey and census

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<sup>2</sup> Most of these statistical standards are accessible to external users through FAO website: <https://www.fao.org/statistics/data-and-statistical-standard-series/en>

microdata, a standard providing guidance on the anonymization and documentation of microdata files has been issued. Finally, FAO has endorsed two statistical standards providing guidance on the production of metadata for geospatial information or georeferenced statistics, and for the production of quantitative dashboards and data visualizations.

- **Cross-cutting standards:** FAO has also developed a statistical standard providing overarching guidance for the implementation of user consultations of FAO statistical databases and on the use of the UN M49 classification to unambiguously identify country and areas in statistical production processes.

### **4.3. Structured quality assessments**

Compliance with the SDQAF, as well as with relevant statistical standards, is monitored through a combination of different types of quality assessments coordinated by the Data Quality Unit.

#### **4.3.1 Quality Self-Assessments**

FAO conducts regular quality self-assessments using the Quality Assessment and Planning Survey (QAPS), a biannual internal survey through which officers responsible for statistical or data activities evaluate the extent to which their processes and outputs comply with the SDQAF. The first version of the QAPS questionnaire, developed in 2016 based on practices of other statistical organizations and tailored to FAO's decentralized production context, was initially designed for traditional statistical outputs. It has since been progressively expanded to accommodate a wider range of data sources and to distinguish between statistical outputs and other data products.

Questions included in the QAPS questionnaire are mapped to the 16 SDQAF principles and to the phases of the Generic Statistical Business Process Model (GSBPM), ensuring that quality monitoring covers the full lifecycle of statistical and data activities. The tool consists primarily of single- and multi-select questions and is supported by a scoring methodology that generates comparable quality scores by statistical output, SDQAF principle and GSBPM phases. This methodology is periodically refined to reflect new standards and framework updates, while maintaining sufficient stability to ensure comparability over time.

Recent editions of the QAPS have strengthened coverage of emerging production practices, including the use of non-traditional and geospatial data sources, the documentation of data collection and processing methods, the verification of licensing and terms of use for external data, and the transparency and usability of dashboard-based dissemination. Through this calibrated evolution, the QAPS maintains longitudinal comparability while remaining responsive to new data acquisition modalities and dissemination channels.

#### **4.3.2 In-depth quality assessments**

In-depth quality assessments complement self-assessment procedures by providing a more detailed review of selected statistical or data activities, focusing on processes of high visibility or strategic relevance, or on statistical outputs where QAPS results indicate significant weaknesses. Each assessment is conducted by a team composed of statisticians from the DQU and external subject-matter experts, ensuring both technical rigor and impartiality.

Like self-assessments, in-depth reviews examine quality by SDQAF principle and across all phases of the statistical lifecycle. However, they allow a more nuanced evaluation by adjusting emphasis on specific principles, quality dimensions or GSBPM phases, depending on the characteristics of the activity. This may include, for instance, a detailed review of source selection and validation procedures, an assessment of methodological assumptions and their impact on outputs, and an

examination of whether the production process achieves the intended quality objectives in a cost-effective and sustainable manner.

Because these exercises are resource-intensive, only a limited number of in-depth assessments can be undertaken each year. Activities are selected by the Chief Statistician and the DCG. Once an activity is selected, the DQU is responsible for establishing the assessment team and preparing the Terms of Reference, which define the objectives, scope, roles, and the overall timeline.

The assessment starts with a review of documentation and datasets and continues with meetings and semi-structured interviews with data producers, internal partners and, when relevant, key users. A customized version of the QAPS checklist guides the analysis, and compliance with applicable statistical standards is systematically verified. The findings are consolidated into a report with actionable recommendations, and an improvement plan agreed with the responsible FAO officers. Through this mechanism, in-depth assessments support not only compliance but also institutional learning and continuous methodological strengthening.

#### **4.3.3 User consultations**

User consultations are one of FAO's core instruments for assessing the output dimension of quality, particularly relevance and accessibility. Conducted in line with a dedicated corporate statistical standard, they collect structured feedback on user satisfaction, data needs and user characteristics, as well as users' perception of key quality dimensions.

User consultations provide direct evidence of compliance with Principles 12 (Relevance), Principle 16 (Accessibility and Clarity) and indirectly capture users' perceptions of accuracy and reliability, timeliness and punctuality, and coherence and comparability (Principles 13-15). By systematically integrating user perspectives into quality monitoring, FAO reinforces the principle that statistical quality must be assessed not only internally but also through structured external validation.

#### **4.3.4 Other types of quality assessment**

In addition to procedures discussed above, FAO also implements targeted standard-based assessments when recurring weaknesses are identified in specific areas or phases of the statistical production process. These assessments focus on compliance with corporate statistical standards and are typically triggered by patterns observed through QAPS results or user consultations.

By concentrating on defined principles or specific production phases, standard-based assessments function as corrective instruments between broad monitoring and full in-depth review. They strengthen methodological alignment across domains and ensure more consistent application of SDQAF Quality Principles.

FAO also conducts regular processes of pre-release peer review, a flexible quality assurance mechanism through which statistical and data outputs are shared with internal stakeholders prior to dissemination to validate results and collect expert feedback. Led by FAO technical Units and Divisions, these peer reviews help improve accuracy, clarity, and usability of outputs while supporting methodological reflection and continuous improvement. They complement other routine validation for high-visibility datasets or complex methodological updates. Structured peer review processes allow experts from different FAO units to scrutinize methods, assumptions and dissemination practices. This systematic practice reduces the risk of methodological drift and supports continuous improvement.

## 5. Innovation to strengthen quality of agricultural statistics

Innovation is central to FAO's statistical work, driven by rapid technological change and expansion to the use of new data sources, analytical methods, and dissemination tools. The growing availability of geospatial data, administrative records, big data and digital platforms offers significant opportunities to address data gaps and improve the timeliness, granularity and relevance of statistics on food and agriculture. At the same time, these innovations introduce new risks, as many of these sources and tools were not designed for statistical purposes and may raise challenges related to sustainability of access, legal and licensing constraints, privacy protection, methodological transparency and reproducibility. Leveraging innovation in official statistics therefore requires a structured governance approach that enables modernization while safeguarding trust, quality, and comparability.

Recognizing that non-official data sources can complement official statistics only when their fitness for purpose is carefully assessed and when transparent governance and accountability mechanisms are in place, FAO has embedded in its SDQAF considerations on the suitability and trustworthiness of data sources (Principles 8), and reinforced the best practices recommended with respect to data protection, documentation and cooperation with data providers.

To operationalize these principles, FAO has developed three new Statistical Standards that embed innovation within a robust quality assurance framework.

- The **Statistical Standard on the acquisition and use of non-statistical data sources (including big data) for statistical purposes** addresses the growing use of digital and non-traditional data in FAO statistical production. While such sources - ranging from administrative records to data generated by platforms, devices and sensors - offer substantial potential to fill data gaps and improve timeliness and granularity, they also introduce risks related to statistical integrity, including those related to bias, intellectual property, privacy, sustainability of access and methodological reproducibility. The Standard provides a structured framework governing the end-to-end use of non-statistical data sources, clarifying scope and definitions, and providing cross-cutting guidance for their acquisition. Operationally, the Standard translates governance principles into phased technical recommendations aligned with a structured production cycle comprising an input phase considering the data acquisition, throughput phases covering data transformation and statistical compilation, and an output phase focused on dissemination and quality reporting. Each phase is subject to quality checks and governance controls, with clearance procedures and corporate standards acting as practical checkpoints before new data sources are institutionalized. The Standard is currently at the last stages of finalization before endorsement.
- The **Statistical Standard on metadata dissemination for geospatial information and spatially represented data** [3] responds to FAO's increasing production and dissemination of geospatial outputs and integration of geospatial information with traditional data sources. As geospatial products multiply, quality and trust increasingly depend on standardized documentation. Hence, the standard aims to harmonize the preparation and dissemination of reference metadata accompanying geospatial information published through FAO platforms, building on the ISO 19115 framework and providing explicit mapping to SDMX reference metadata concepts. It defines a minimum set of metadata elements to support findability, accessibility, interoperability, and reusability (FAIR), thereby reducing fragmentation and inconsistency across technical units.

- Finally, the **Statistical Standard on data visualizations and dashboards** [4] addresses the rapid growth of interactive visualization tools that have become central to FAO's dissemination practices. While innovation in visualization can enhance accessibility and clarity, it also introduces risks of duplication, misinterpretation, and reputational exposure. The Standard provides guidance covering the full lifecycle of dashboards and visualizations, including user orientation, source documentation, coherence with corporate platforms, ensuring that innovation in dissemination strengthens transparency, comparability and trust.

In parallel, FAO is modernizing its technical infrastructure by migrating its statistical databases to a centralized Statistical Data Warehouse based on SDMX-compliant tools. Prior to migration, data and metadata are validated and aligned with corporate standards and SDMX structures. This modernization strengthens interoperability, coherence, and metadata harmonization across domains, reinforcing alignment with SDQAF Principles.

Taken together, these instruments demonstrate how FAO approaches innovation as a managed process embedded within a coherent governance, quality assurance, and accountability framework. Against this background, current priorities focus on finalizing the operational rollout of the new statistical standards and strengthening their systematic application across FAO statistical activities. Particular emphasis is placed on ensuring that innovation initiatives are consistently supported by proportionate quality assurance, documentation, and clearance procedures. Next steps include supporting technical units through targeted guidance and internal capacity development, with the objective of consolidating a coherent normative and infrastructural framework that supports the full statistical production process (from data acquisition to dissemination) including for nontraditional data sources and geospatial information.

## 6. Conclusion

FAO's role as a global producer of food and agricultural statistics requires transforming heterogeneous national data inputs into outputs that remain accurate, reliable, timely, comparable, accessible and fit for purpose.

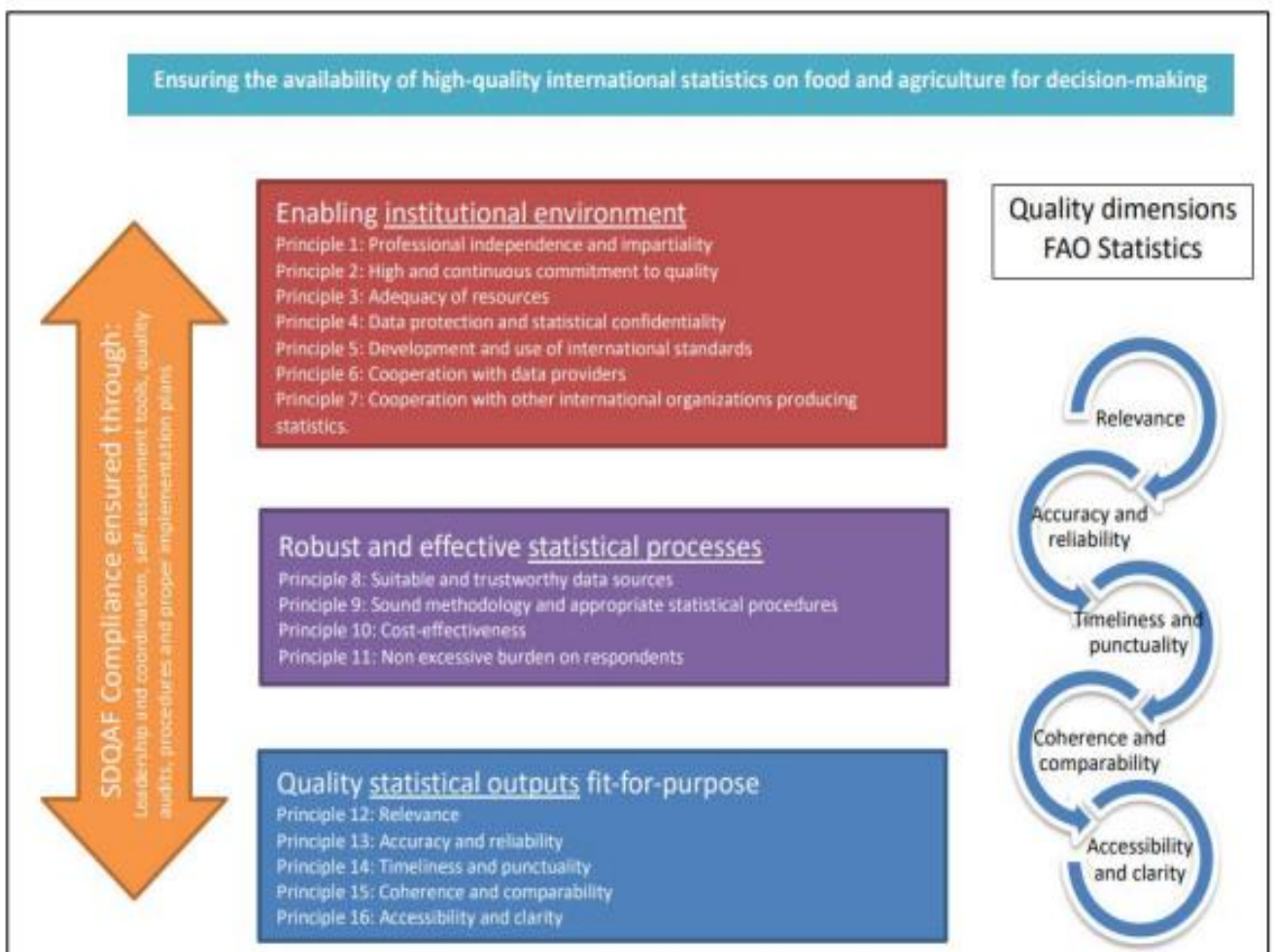
This paper discussed how the Statistics and Data Quality Assurance Framework (SDQAF) provides FAO with a coherent and operational response to these demands by linking quality principles to concrete mechanisms that function across the entire statistical lifecycle. The framework's three-layer structure - covering the institutional environment, statistical processes and outputs - is rendered actionable through governance coordination, corporate policies, statistical standards, clearance procedures, and a combination of quality assessment tools such as the QAPS, in-depth assessments, peer reviews, standard-based assessments and user consultations. Taken together, these instruments embed quality assurance as a routine practice within FAO's day-to-day statistical operations. FAO's experience demonstrates that modernization and integrity are mutually reinforcing when innovation is introduced within clear safeguards and quality assurance mechanisms. The new statistical standards on non-statistical data sources, geospatial metadata, and dashboards illustrate how FAO addresses emerging risks, while reinforcing and promoting innovation in data collection and dissemination practices. Coupled with other corporate efforts such as the ongoing migration toward a SDMX based centralized statistical data warehouse, these measures strengthen interoperability, transparency and coherence across domains. The SDQAF therefore functions not only as a compliance framework but as enabling architecture: it supports innovation while preserving quality, ensuring that new data opportunities further enhance the relevance of FAO's statistical and data outputs for food, nutrition, and agriculture.

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## Annex.

Figure 1: The FAO Statistics and Data Quality Assurance Framework



**Figure Source:** FAO. FAO Statistics and Data Quality Assurance Framework. Rome: Food and Agriculture Organization of the United Nations; 2023.