

Quality in Statistics

EUROSTAT

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Integrating Data Quality Indicators Into the FAO Statistical System

Submitted by Food and Agriculture Organization of the United Nations, Rome, Italy¹

1. Background

The redevelopment of the FAOSTAT Statistical database has provided the FAO Statistics Division with the opportunity to integrate data quality indicators into the FAO Statistical System. This paper provides an overview of the major components of the proposed FAO Statistical data quality assessment and monitoring framework and the integration of it into the statistical process.

Since the early 1990's, the FAO Statistics Division has been developing data quality frameworks and concepts relating to agricultural statistics. The initial work outlined in the paper by Trant (1993), focused on the concepts of accuracy, relevance and timeliness of a statistical estimate. It also discussed the need for sound statistical metadata in order for the user to be able to interpret the statistics. This approach was primarily aimed at national statistical offices and the need to make them accountable for data they publish.

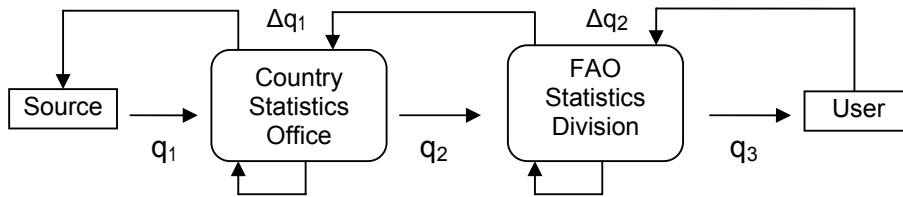
More recently, the FAO Statistics Division has begun using a data quality dimensions very similar to that of Eurostat (2000). In addition to the core Eurostat data quality dimensions, a statistical metadata component was included. The statistical metadata component has been consolidated under the Agricultural Bulletin Board on Data Collection, Dissemination and Quality of Statistics project (ABCDQ) which focuses on national agricultural data that comes into the FAO Statistics Division.

2. Data flow and quality

After reviewing the earlier work undertaken in FAO, a more comprehensive data quality evaluation and monitoring framework was developed. The approach is based on monitoring data quality at three points in the statistical process (q1, q2, and q3), as well as the change in data quality between points q1 and q2 and between points q2 and q3 (see figure 1).

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Figure 1. Data flow and quality assessment



The key aspect to this approach to data quality evaluation and monitoring is the focus on three different points of the statistical process: as the data comes into the country statistics office; as the data comes into the FAO Statistics Division and as the data leaves FAO. By monitoring data quality at these key points (q1, q2 and q3) it is possible to assess value-added by each stage of the process and assess performance. A further benefit to this approach is that it is possible to identify and address data quality problems throughout the statistical process. Feedback loops are incorporated to provide a mechanism for improving data quality. An important aspect of this flow is that the level of data quality inherited from the previous stage thus for example the FAO Statistics Division inherits any data quality problems that are passed on from the national level.

2.1 CountrySTAT - Monitoring data quality at point q1

Monitoring data quality at the source is essential in order to identify a benchmark of quality for the data series. Point q1 is the point before data is processed (edited/validated) by the national statistical agencies. It is common practice in national statistical systems to provide basic information on the quality of the data collection device and data, whether it is a survey, census, administrative records or other data collection process. FAO's Agricultural Bulletin Board on Data Collection, Dissemination and Quality of Statistics project (ABCDQ) was developed to produce data quality information at point q2 in the FAO Data Quality Assessment Framework. This assessment and monitoring at the country level is to be further developed in the CountrySTAT Project (2004). CountrySTAT is a scaled down version of the FAOSTAT Statistical System and provides a mechanism for countries to consolidate statistical data required for national food and agricultural policy analysis and development in one database. The CountrySTAT database will include detailed statistical metadata and data quality indicators into the same format as the FAOSTAT Statistical System and will provide assessment at q1.

2.2 Monitoring data quality at point q2

Once the data has been processed by the national statistics agency, an evaluation of the quality that is disseminated or used by the agency is essential. As noted by the United Nations (2003), "Professional statisticians and reputable statistical institutions are obligated to describe accurately and openly the strengths and weaknesses of the data they publish and explain how much inference the data can support. Although there is no international consensus on how this should be accomplished, the

statistical agency must be sure that its audience is properly informed regarding the following:

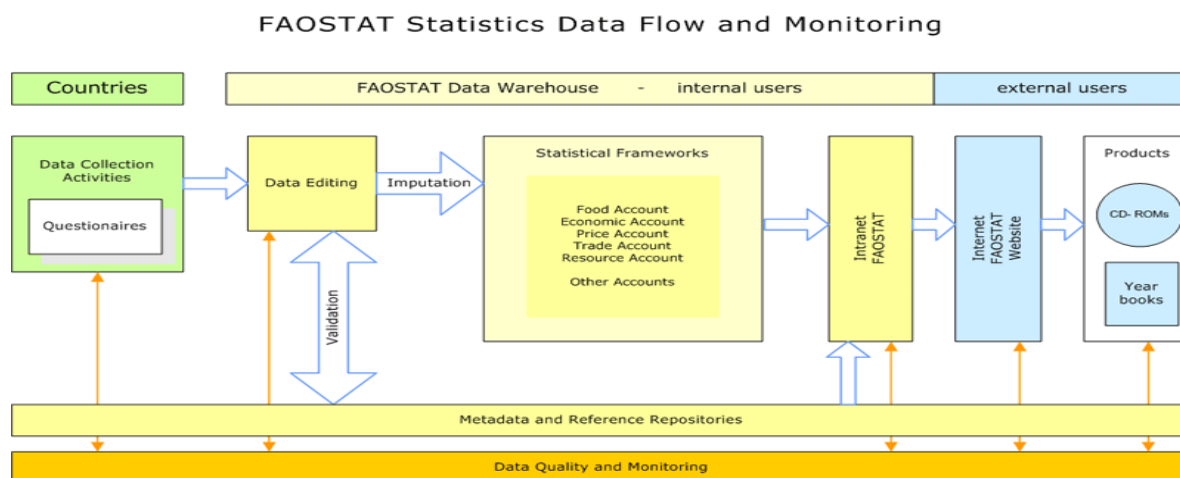
- Where data are located, according to subject and time period;
- How the data were defined and compiled;
- What quality is assigned to the data;
- What related data can be used for comparison or to provide context.”

By monitoring points q_1 and q_2 , a national statistical agency can assess value added by each stage of the processes, and produce estimates of Δq_1 and assess performance.

2.3 Monitoring data quality at point q_3

International statistical agencies add quality and value to national statistical data in various ways. It can involve the actual improvement of national data (via data editing/validation), by providing context or providing internationally comparable data series. An example of the improvement of national data is found when international statistical offices process national merchandise trade statistics. When trade data is missing from a given country for a commodity, it is often possible to use the mirror statistics from the counter-party country (importer or exporter) to estimate the missing commodity data. When an international statistical agency disseminates data (point q_3), it can assess value added by each stage of the process, produce estimates of Δq_2 and assess performance. Figure 2. provides an overview of the data flow and quality assessment from points q_2 to q_3 in the context of the FAOSTAT Statistical System.

Figure 2. Data flow and quality assessment from points q_2 to q_3



3. Dimensions of quality assessment and analysis in the FAOSTAT statistical process

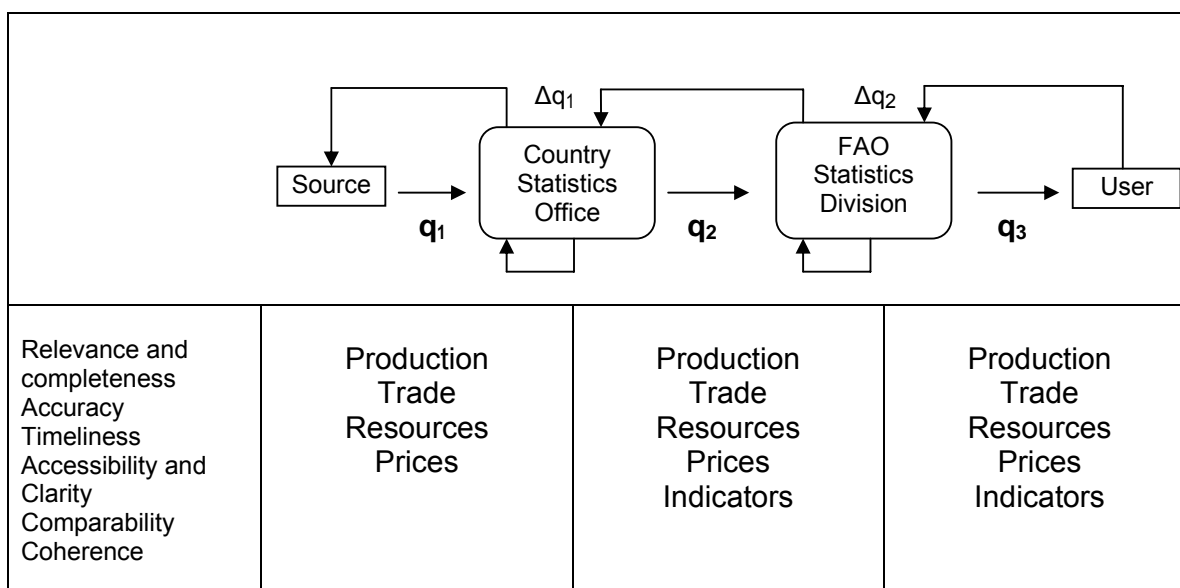
The data quality assessment and monitoring will be carried out on two major dimensions (data domains and countries -see figure 3 for an overview)) whilst the monitoring will be carried out from year to year on these dimensions. The major sub-domains are:

- Production (crops, livestock)
- Trade (import, export)
- Prices (producer, consumer, trade)
- Resources (labour, machinery, fertilizer, pesticides, land)

Whilst it is theoretically possible to calculate data quality indicators at the data series level, it is practically infeasible due to resource constraints. Therefore, the initial focus of quality assessment and analysis in the FAOSTAT statistical process will be on the statistical domain and sub-domain levels. If however a serious data quality issue is identified in a sub-domain, then further detailed analysis at the data series level will be necessary.

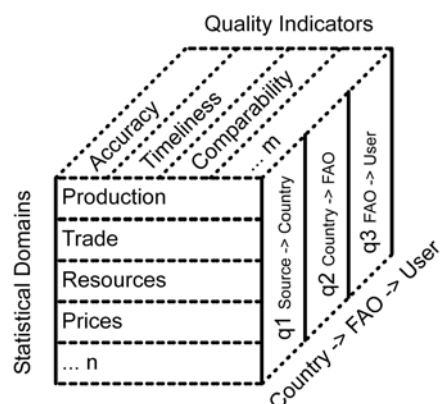
The Food and Agriculture Organization of the United Nations currently has 188 Member Nations and data is collected on an annual basis from these countries. A summary data quality assessment of data obtained from each country is to be completed regularly with feedback provided if necessary.

Figure 3. Data Quality Dimensions, Statistical Domains and assessment at points q1, q2 and q3



The overall conceptual structure of data quality assessment and monitoring in the FAOSTAT Statistical System is provided in figure 4.

Figure 4. FAOSTAT Data Quality Cube



4. Dimensions of the quality concept in the FAOSTAT statistical process

FAO is attempting to include standard data quality dimensions and indicators where possible in the FAOSTAT Statistical System. A list of provisional FAOSTAT quality indicators is included in Annex1. These data quality indicators will be calculated at key points q1, q2 and q3 where possible. Most data quality indicators include some objective measurement on the data domain or country performance. The FAO Statistical system will supplement these objective measurements with a subjective review and adjustment where necessary (see figure 5 for overview).

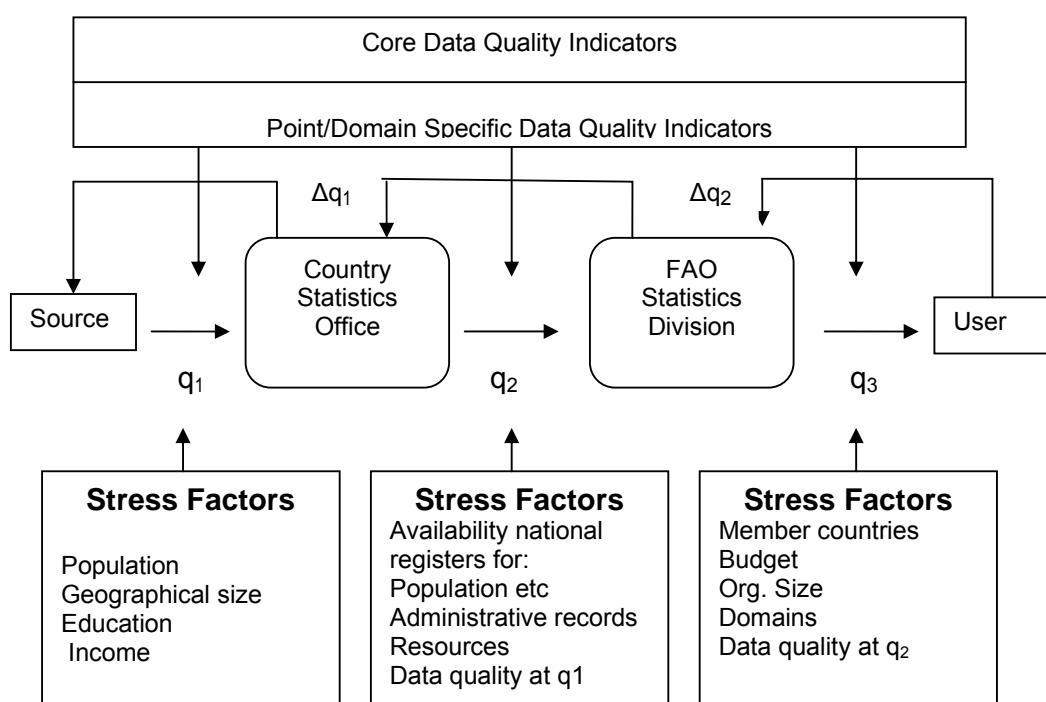
Figure 5. Objective and subjective measures in FAOSTAT statistical process

Data Quality Dimensions	Assessment	
	Objective	Subjective
Relevance and completeness	Yes	Yes
Accuracy	Yes	Yes
Timeliness	Yes	Yes
Accessibility and Clarity	Yes	Yes
Comparability	Yes	Yes
Coherence	Yes	Yes

8. Stress factors - a subjective assessment and adjustment

When countries, regardless of size, population, level of development, etc, are asked to provide statistical data and are evaluated on quality concepts (such as relevance, accuracy, timeliness and punctuality, accessibility and clarity, comparability and coherence), there is no “level playing field” for evaluation. Some specific data series are harder for some countries to collect and process than for other countries and this needs to be taken into consideration in a subjective assessment and adjustment. For example, a developing country that is very large both geographically and has a large population is less likely to be able to perform an agricultural census as often as a smaller, more developed country. It would therefore be hard to justify a comparison of these two countries using the same standard data quality criteria. See figure 6. for examples stress factors at various data quality points.

Figure 6. Stress factors and data quality indicators at points q1, q2 and q3



Work is underway in the FAO Statistics Division to provide a consistent stress factor adjustment framework for data quality adjustment. An example of a stress factor adjustment would be the subjective adjustment of the data quality indicator by a factor based on how difficult it was for a country to produce data in a timely fashion if these was a financial or environmental crisis in the country.

9. Data quality Stamp

One of the quality practices being developed by the FAO Statistics Division is a “Quality Stamp” to be attached to every dataset included in the FAOSTAT statistical system. The FAOSTAT Statistical Quality Stamp will inform users that the data has met the minimum requirements for FAOSTAT and has undergone various checks to ensure quality.

The minimum data requirements for FAOSTAT will include:

- Global coverage;
- Regular, committed sustainable data collection activity;
- Time-series data;
- Data quality assessment performed;
- Statistical metadata available;
- Data is edited and validated.

6. Displaying (visualization) of Data Quality information

Data quality indicators in FAO’s ABCDQ

The data quality assessment provides a guide to the relevance, accuracy, timeliness, punctuality, accessibility, clarity, comparability, coherence, completeness and sound metadata available to support the data from countries. Data and the methods used to collect the data are subjectively assessed by experts in the specific statistical domain. Countries are then allocated a colour code based on the assessment, with a Green code reflecting high standards of data quality, an Amber code reflecting medium standards of data quality. A Red code is given where there are low standards of data quality or where little or no information is available to assess data quality. Countries are encouraged to contact the FAO Statistics Division and provide detailed metadata to assist data users in understanding their data, improve where the overall data quality and quality assessment and make any adjustments or re-classifications where necessary.

A Country Data Completeness indicator for the FAOSTAT database provides the user with indicators of the availability of official data for the past four years. The indicator (presented as a barometer) is calculated for crops and livestock production as well as agricultural trade (export and import). Different algorithms are applied for each area. See figures 7 and 8 for examples of FAOSTAT of Data Quality visualization.

Figure 7. Data Quality Traffic light and Barometer (objective assessment)

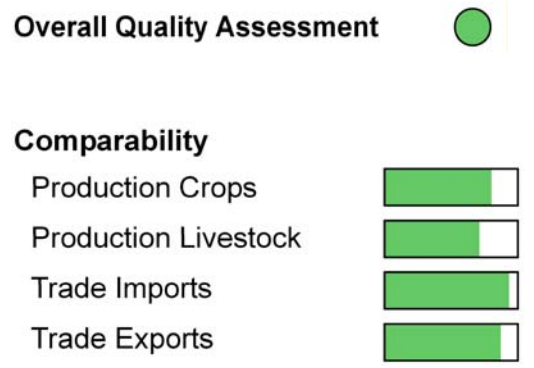
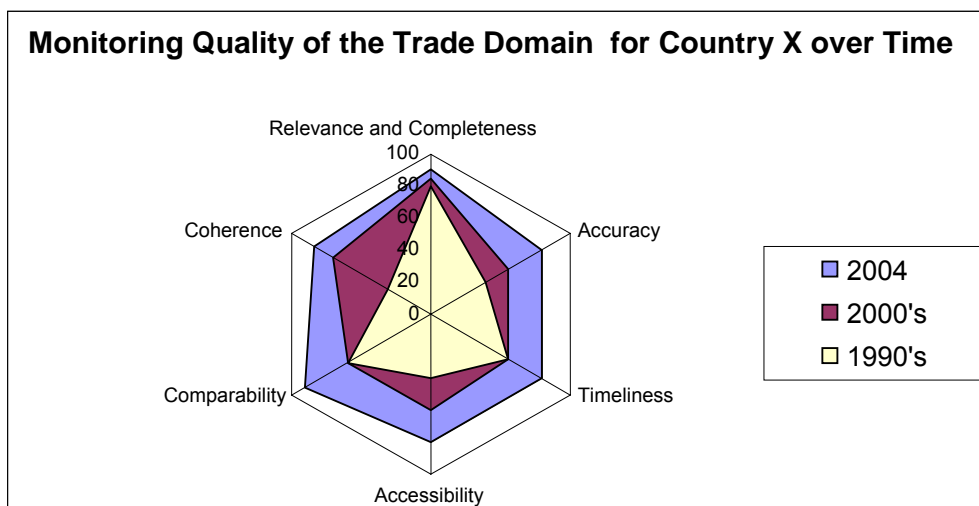


Figure 8. Monitoring Quality of the Trade Domain for Country X over Time



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Provisional FAOSTAT Quality indicators

Quality dimensions	Indicators
Relevance and Completeness	User satisfaction (feedback) Number of publications disseminated and/or accesses to databases Rate of available statistics compared to FAO mandate, the FAO Medium Term Plan and Programme Work and budget
Accuracy	Coefficient of variation (CV) Unit response rates Item response rates Editing rates and ratios Imputation rates and ratios Modeling / balancing ratios Over-coverage and misclassification error rates Average size of revisions Asymmetries for statistics mirror flows
Timeliness	Punctuality of time schedule of effective collection and publication Average time between the end of reference period and the date of publication
Accessibility and Clarity	Number and types of means used for disseminating statistics
Comparability	Number and proportion of differences in concepts or/and measurement from the FAO/United Nations norms Number and length of comparable time series
Coherence (comparability over time or over datasets)	Number and proportion of sets of statistics that satisfies the requirements for the main secondary use