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Miscellanea

Under the heading Miscellanea, essays will be published dealing with topics considered to be of general interest to the readers. All contributions will be refereed for their compatibility with this criterion.

Statistical Standards: A Global Perspective

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1. Introduction

The availability of quick and effective communication together with low cost relatively high speed travel have shrunk the world. It is possible to watch American TV in Luxemburg after flying from New York to Paris in 3.5 hours. Stock market prices are quoted in a continuous cycle around the world. Much of this progress is due to standardization. Telecommunications standards regulate the flow of correct information from Atlanta to Luxemburg, the flight from New York to Paris is safe and more consistent because of rigidly enforced rules in both countries, and the stock prices quoted are accepted with confidence because of accepted codes of conduct.

What has this to do with statistics? Standardization of statistical methods provides an equal measure of confidence between business partners that statistical methodology is applied:

- Correctly
- Consistently
- Competently.

With standardization, a spirit of trust is promoted and results believed.

2. Why Statistical Standards

It is easy to see why standardization is necessary and desirable in statistics. It is still possible to find books in which the symbol s is used with a denominator of n. The Grubbs test for outliers has a lower tail critical value in contradistinction to most statistical tests. The British use 3.095σ limits on control charts. And on and on. Statistical methods are sometimes not user friendly because of lack of standardization.

Standardization provides these benefits:

- Necessary in two and multi-party transactions (such as in bulk sampling, determination of process capability, etc.)

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- Provides a vehicle of communication and consistency between languages
- Supplements management and other standards (such as ISO 9000)
- Provides a baseline for modification if necessary
- Provides a format for record
- Simplifies instruction to others
- Avoids pitfalls
- Promotes harmony
- Encourages statistical applications
- Heightens understanding
- Insures correctness, consistency, competence.

Did you ever hear two statisticians argue over how a test was run? With standardization the arguments are before the fact rather than before the court.

3. Standards Writing Bodies

Where do standards come from? In the United States the American National Standards Institute (ANSI) is the national consensus body which oversees the creation and maintenance of standards. Standards are written by various bodies and authenticated by ANSI as national standards.

Standards writing bodies in the U.S., of interest to statisticians, include the American Society for Quality Control (ASQC) and the American Society for Testing and Materials (ASTM) among others. Standards writing bodies of interest internationally include the International Organization for Standardization (ISO) and the International Electro-technical Commission (IEC). We will use these to illustrate the interrelations which exist in the standards writing world. These are shown in Appendix 1.

Statistical standards are coordinated nationally by ANSI Accredited Standards Committee ANSI ASC Z-1 while international standards go through the U.S. Technical Advisory Group (TAG) of ISO Technical Committee TC-69. ASQC holds the secretariat (administrative agency) for both these committees. ISO TC-69 is composed of representatives of countries from throughout the world. ASQC also holds the secretariat of the U.S. TAG of IEC Technical Committee TC-56 which deals with dependability, while ISO deals with all other areas of statistics. Thus, the world of statistical standardization is complex. This complexity is enhanced by the fact that some other governments are involved directly in developing standards. In the U.S. the system of standardization is strictly voluntary and is not subsidized by the government.

3.1. *Statistical committees*

The committees and subcommittees of interest to statisticians are:

ISO TC69 – *Statistical Methods* – Subcommittees (SC)
- SC1 – Terminology and Symbols
- SC2 – Inactive
- SC3 – Applications of Statistical Methods
- SC4 – Statistical Process Control
- SC5 – Acceptance Sampling
- SC6 – Measurement Uncertainty

IEC TC56 – *Reliability and Maintainability* – Working Groups (WG)
- WG1 – Terminology
- WG2 – Data Collection
- WG3 – Equipment Reliability Testing
- WG4 – Verification and Evaluation Procedure
- WG5 – Formal Design Review
- WG6 – Maintainability
- WG7 – Component Reliability
- WG8 – Reliability and Maintainability Management
- WG9 – Analysis Techniques for System Reliability

WG10 – Software Aspects
WG11 – Human Aspects of Reliability
WG12 – Risk Analysis

ANSI ASC Z-1 – *Quality Assurance* – Subcommittees

- Administrative
- Definitions
- Interface
- Management
- Technology

ASTM E-11 – *Quality and Statistics* – Subcommittees (E11.xx)

E11.01 – Committee Interface
E11.02 – Sampling and Estimation
E11.03 – Statistical Analysis and Control Techniques
E11.04 – Development and Evaluation of Test Methods
E11.11 – Quality Implementation
E11.91 – Long Range Planning
E11.93 – Editorial
E11.94 – Terminology

It is important to recognize these committees in understanding statistical standardization.

4. World Wide Standards

Statistical standards encompass such areas as:

- Hypothesis Testing and Estimation
- Process Quality Control
- Acceptance Sampling
- Measurement Error/Interlaboratory Testing
- Definitions and Nomenclature
- Quality Systems Management
- General

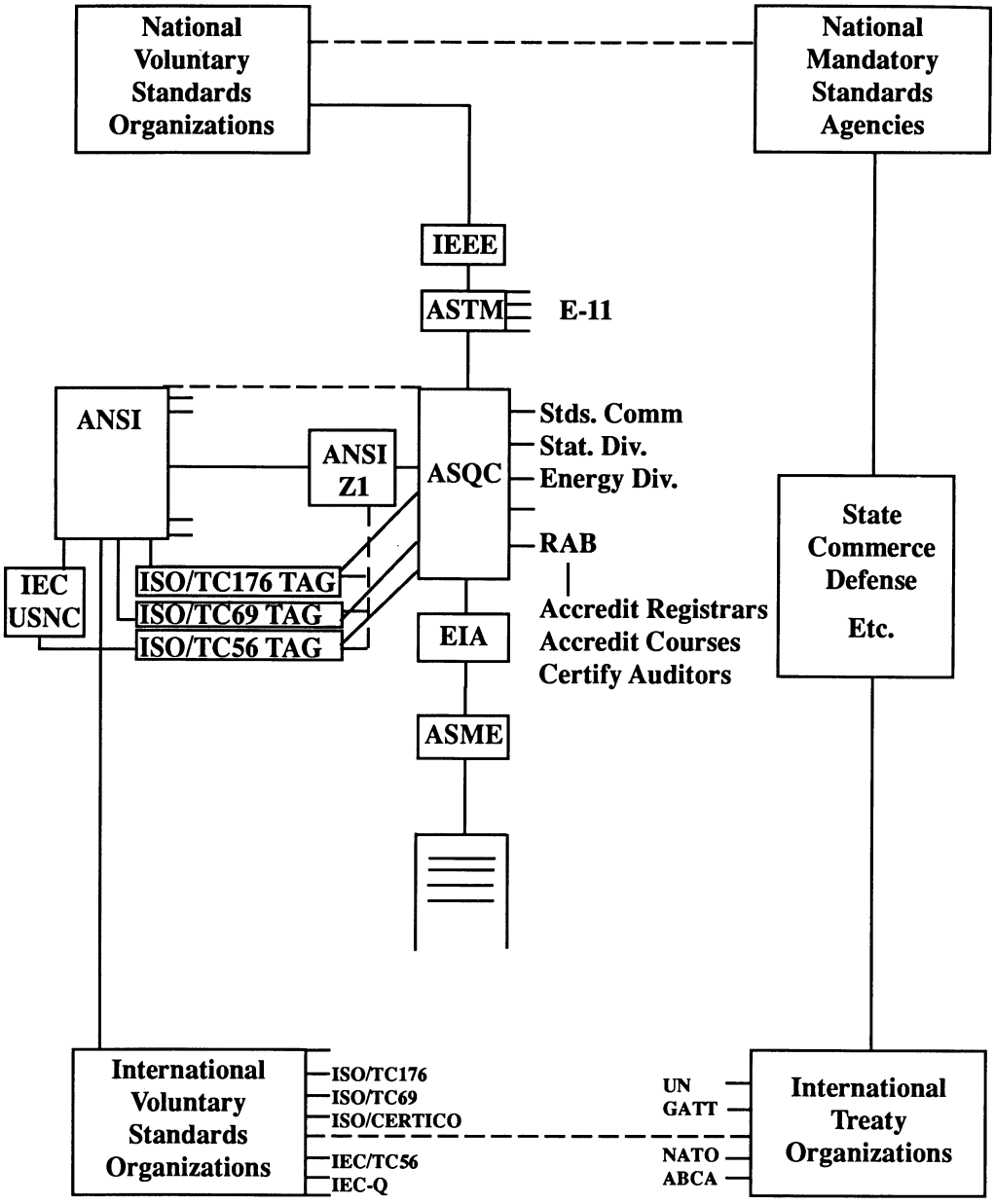
A listing of some international standards is given in Appendix 2. Listing of national standards can be obtained from the national bodies cited (e.g., ASQC and ASTM).

5. Conclusion

The ISO quality management standards series ISO 9000 will be updated to include a revised paragraph 20 dealing with statistics. This will indicate that statistical techniques require determination of need and justification of procedures used. Statistical standards provide the most straight forward approach to justification and help in the determination of need. Interest in statistical standards can be expected to increase dramatically in the future.

APPENDIX

Appendix 1. Quality Assurance Standards Liaison in the U.S.A.



Appendix 2. International Statistical Standards

ISO International Organization for Standardization
EN European Economic Community
DP Draft proposal (ISO)
CD Committee Draft (ISO)
TR Technical Report

Hypothesis testing and estimation

ISO 2602 – 1973	Statistical interpretation of test results – Estimation of the mean – Confidence interval
ISO 2854 – 1976	Statistical interpretation of data – Techniques of estimation and test relating to means and variance
ISO 3207 – 1975	Statistical interpretation of data – Determination of a statistical tolerance interval Addendum 1 – 1978
ISO 3301 – 1975	Statistical interpretation of data – Comparison of two means in the case of paired observations
ISO 3494 – 1976	Statistical interpretation of data – Power of tests relating to means and variances
DP 5479	Normality tests
ISO 7585	Statistical interpretation of data – Comparison of a proportion with a given value
ISO 7868	Estimation of a proportion (confidence interval)
ISO 7912	Comparison of two proportions
ISO 8595	Interpretation of statistical data – Estimation of the median
CD 10576	Specifications: Statistical principles for the construction of limiting values and the comparison of test results therewith
CD 11453	Statistical interpretation of data: Tests and confidence intervals relating to proportions

Process quality control

ISO 7870	Control charts – General guide and information
CD 10576	Specifications: Statistical principles for the construction of limiting values and the comparison of test results therewith
CD 11453	Statistical interpretation of data: Tests and confidence intervals relating to proportions

Process quality control

ISO 7870	Control charts – General guide and information
TR 7871	Introduction to cumulative sum charts

ISO 7873	Control charts for arithmetic average with warning limits
ISO 7966	Acceptance control charts
ISO 8258	Shewhart control charts

Acceptance sampling

ISO 2859-0	Sampling procedures for inspection by attributes – Part 0: General introduction (earlier issue was Addendum ISO 2859)
ISO 2859-1	Sampling procedures for inspection by attributes – Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection
ISO 2859-2	Sampling procedures for inspection by attributes – Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection (earlier issue was ISO 7362)
ISO 2859-3	Sampling procedures for inspection by attributes – Part 3: Skip lot sampling procedures
ISO 3951	Sampling procedures and charts for inspection by variables for percent defective
ISO 8422	Sequential sampling plans for inspection by attributes (proportion nonconforming and nonconformities per unit)
ISO 8423	Sequential sampling plans for inspection by variables for percent nonconforming (known standard deviation)
TR 8550	Acceptance sampling, guide for selection of a sampling scheme, system or plan (to be published as a Technical Report)
CD 10725	Acceptance sampling plans for bulk material

Measurement error/interlaboratory testing

ISO 5725	Precision of test method – Interlaboratory test repeatability and reproducibility (being replaced by 5725-1 to -6)
ISO 5725-1	Accuracy (trueness and precision) of test methods and results – Part 1: General principles and definitions
ISO 5725-2	Accuracy (trueness and precision) of test methods and results – Part 2: A basic method for the determination of repeatability and reproducibility of standard measurement method
ISO 5725-3	Accuracy (trueness and precision) of test methods and results – Part 3: Intermediate measures of precision of a test method
ISO 5725-4	Accuracy (trueness and precision) of test methods and results – Part 4: Basic method for estimating the trueness of a test method
ISO 5725-5	Accuracy (trueness and precision) of test methods and results – Part 5: Test alternative to the standard test method
ISO 5725-6	Accuracy (trueness and precision) of test methods and results – Part 6: Practical applications

DP 8466-3	Calibration and evaluation of analytical procedures and the estimation of performance characteristics (TC 147 SC 7)
ISO 10012	Measurement
EN 29 001	Quality Systems – Model for quality assurance in design/development, production, installation, and servicing
EN 29 002	Quality Systems – Model for quality assurance in production and installation
EN 29 003	Quality Systems – Model for quality assurance in final inspection and test

Definitions and nomenclature

ISO 3534 – 1977	Statistics – Vocabulary and symbols Part 1. Probability and general statistical terms Part 2. Statistical quality control Part 3. Design of experiments (Bilingual)
ISO 8402	Quality – vocabulary
EOQC	Glossary

Quality systems management

ISO 9001	Quality systems – Model for quality assurance in design/development, production, installation, and servicing
ISO 9000	Quality management and quality assurance standards – Guidelines for selection and use
ISO 9001	Quality systems – Model for quality assurance in design/development, production, installation, and servicing
ISO 9002	Quality systems – Model for quality assurance in production and installation
ISO 9003	Quality systems – Model for quality assurance in final inspection and test
ISO 9004	Quality management and quality system elements – Guidelines
ISO 10004.2	Quality assurance for services – for software – for process industries
ISO 10011	Generic guidelines for auditing quality systems Part 1. Guidelines for auditing Part 2. Qualification criteria for auditors Part 3. Guidelines for managing audit programs
EN 45 001	General criteria for operation of testing laboratories
EN 45 002	General criteria for assessment of testing laboratories
EN 45 003	General criteria for laboratory accreditation bodies

General

ISO 7874	Application of statistical methods and standardization of specifications
DP 7874	Application of statistical methods in standardization and specification (guide)
DP 10205	Classification of requirements of manufacturing documentation
EN 45 011	General criteria for certification bodies operating product certification
EN 45 013	General criteria for certification bodies operating certification of personnel
EN 45 014	General criteria for supplier's declaration of conformity.

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