



BSI Standards Publication

**Statistical methods for
implementation of Six Sigma
— Selected illustrations of
contingency table analysis**

Currently in preview, click buy full version

National foreword

This Published Document is the UK implementation of ISO/TR 16705:2016.

The UK participation in its preparation was entrusted to Technical Committee MS/6, Methodologies for business process improvement using statistical methods.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016. Published by BSI Standards Limited 2016

ISBN 978 0 580 74469 3

ICS 03.120.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 August 2016.

Amendments issued since publication

| Date | Text affected |
|------|---------------|
|------|---------------|

TECHNICAL REPORT

ISO/TR 16705

First edition
2016-08-15

Statistical methods for implementation of Six Sigma — Selected illustrations of contingency table analysis

*Méthodes statistiques pour l'implémentation de Six Sigma —
Exemples sélectionnés d'application de l'analyse de tableau de
contingence*



Reference number
ISO/TR 16705:2016(E)

© ISO 2016

Currently in preview, click buy full version

Licensed copy: Lewis Poole, ISO Exchange - Michigan, Version correct as of 09/08/2016.

Currently in preview, click buy full version



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016. Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

| | Page |
|---|-----------|
| Foreword..... | iv |
| Introduction..... | v |
| 1 Scope..... | 1 |
| 2 Normative references..... | 1 |
| 3 Terms and definitions..... | 1 |
| 4 Symbols and abbreviated terms..... | 2 |
| 5 General description of contingency table analysis..... | 2 |
| 5.1 Overview of the structure of contingency table analysis..... | 2 |
| 5.2 Overall objectives of contingency table analysis..... | 3 |
| 5.3 List attributes of interest..... | 3 |
| 5.4 State a null hypothesis..... | 3 |
| 5.5 Sampling plan..... | 3 |
| 5.6 Process and analyse data..... | 4 |
| 5.6.1 Chi-squared test..... | 4 |
| 5.6.2 Linear trend test..... | 6 |
| 5.6.3 Correspondence analysis..... | 6 |
| 5.7 Conclusions..... | 7 |
| 6 Description of Annexes A through D..... | 7 |
| Annex A (informative) Distribution of number of technical issues found after product release to the field..... | 8 |
| Annex B (informative) People's perception about contented life..... | 15 |
| Annex C (informative) Customer satisfaction research on a brand of beer..... | 20 |
| Annex D (informative) Proportions of nonconforming parts of production lines..... | 26 |
| Bibliography..... | 31 |

Licensed copy: Lewis Poole, ISO Exchange - Michigan, Version correct as of 09/08/2016.

Currently in preview, Click buy full version

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 19, *Applications of statistical methods*, Subcommittee SC 7, *Applications of statistical and related techniques for the implementation of Six Sigma*.

Introduction

The Six Sigma and international statistical standards communities share a philosophy of continuous improvement and many analytical tools. The Six Sigma community tends to adopt a pragmatic approach driven by time and resource constraints. The statistical standards community arrives at rigorous documents through long-term international consensus. The disparities in time pressures, mathematical rigor, and statistical software usage have inhibited exchanges, synergy, and mutual appreciation between the two groups.

The present document takes one specific statistical tool (Contingency Table Analysis), develops the topic somewhat generically (in the spirit of International Standards), then illustrates it through the use of several detailed and distinct applications. The generic description focuses on the commonalities across studies designed to assess the association of categorical variables.

The Annexes containing illustrations do not only follow the basic framework, but also identify the nuances and peculiarities in the specific applications. Each example will offer at least one “winkle” to the problem, which is generally the case for real Six Sigma and other fields application.

Currently in preview, click buy full version

Statistical methods for implementation of Six Sigma — Selected illustrations of contingency table analysis

1 Scope

This document describes the necessary steps for contingency table analysis and the method to analyse the relation between categorical variables (including nominal variables and ordinal variables).

This document provides examples of contingency table analysis. Several illustrations from different fields with different emphasis suggest the procedures of contingency table analysis using different software applications.

In this document, only two-dimensional contingency tables are considered.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3534-1 and ISO 3534-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

categorical variable

variable with the measurement scale consisting of a set of categories

3.2

nominal data

variable with a nominal scale of measurement

[SOURCE: ISO 3534-2:2006, 1.1.6]

3.3

ordinal data

variable with an ordinal scale of measurement

[SOURCE: ISO 3534-2:2006, 1.1.7]

3.4

contingency table

tabular representation of categorical data, which shows frequencies for particular combinations of values of two or more discrete random variables

Note 1 to entry: A table that cross-classifies two variables is called a “two-way contingency table;” the one that cross-classifies three variables is called a “three-way contingency table.” A two-way table with r rows and c columns is also named “ $r \times c$ table.”

EXAMPLE Let n items be classified by categorical variables X and Y with levels X_1, X_2 and Y_1, Y_2 , respectively. The number of items with both attribute X_i and Y_j is n_{ij} . Then, a 2×2 table is as follows.