# Training Course Q2014

# 1. Title:

Visualization Techniques & Statistical Graphics

## 2. Instructors:

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## 3. Abstract:

Visualization of data has become an important technique for data analysis not only for communicating results of statistical projects but also for supporting the analytical process. The general goal of visualization is to improve insight and understanding of real world phenomena that are described and represented by data. The challenge of creating adequate and informative visual representations of complex data structures plays an important role in the discussion about quality in statistics.

The course starts with a brief glimpse on general design principles that have to be considered for producing statistical graphics. On the one hand, these graphics should grab the reader's attention by being innovative and attractive, and on the other hand they have to be clearly understandable and valid by truly representing the data.

A comprehensive overview of the most important types of statistical graphics will be presented and their particular strength in envisioning different aspects of the underlying data will be discussed. Finally, various practical software solutions will be presented and discussed in a hands-on session.

During the whole course numerous practical examples will be shown and discussed.

This course addresses anyone involved in the process of producing, communicating or just perceiving statistical reports and analyses of data. No specific knowledge beyond a basic understanding of statistical principles is required. The course is specifically targeted, but not restricted to practitioners working in National Statistical Institutes, Central Banks, and international organizations as well as academics working in research institutions or universities.

## 4. Outline

9:30 – 11:00 Introduction: Visual Representations of Quantitative Information

- Information Design
- Visual Perception
- Fundamental Concepts of Visualization
- General design principles (e.g., least significant difference, small multiples)
- 11:00 11:15 Morning Break
- 11:15 13:00 Statistical Graphics: Overview
  - Objectives of Graphical Concepts in Data Analysis
  - Analytical Graphs versus Presentational Graphs
  - Graphs versus Tables
  - Visualization of Univariate Data
  - Visualization of Bivariate Data
- 13:00 14:00 Lunch
- 14:00 15:15 Advanced Techniques for Statistical Graphics
  - Visualization of Multivariate Data
  - Visualization of Big Data
  - Principles of Dashboard Design
  - Interactive Graphical Presentations
- 15:15 15.30 Afternoon Break
- 15.30 16.45 Workshop: Practical Software Demonstrations
  - MS-Excel: Interesting features and avoidance of typical pitfalls
  - Visualization with R (Trellis plots, lattice, ggplot2 and more)
  - Tableau
  - GGobi
  - Mondrian
  - Web graphics with D3

16.45 – 17.00 Q&A, Wrap-up, and Evaluations

#### 5. Learning outcomes

Participants taking part in this course will gain a better understanding of the principles of data visualization and statistical graphics, helping them to more effectively present and analyze data.

#### 6. Selected References

- Cleveland, William S. (1994). The Elements of Graphing Data (Revised Edition). Summit, NJ: Hobart Press.
- Cook, Dianne and Deborah F. Swayne. (2007). Interactive and Dynamic Graphics for Data Analysis with R and Ggobi. New York: Springer.
- Few, Stephen C. (2012). Show Me the Numbers: Designing Tables and Graphs to Enlighten (Second Edition). Burlingame, CA: Analytics Press.
- Murrell, Paul. (2011). R Graphics (2<sup>nd</sup> Edition). Boca Rotan, FL: Taylor and Francis Group.
- Tufte, Edward R. (2001). The Visual Display of Quantitative Information (2<sup>nd</sup> Edition). Cheshire, CT: Graphics Press.
- Unwin, Antony; Martin Theus; Heike Hofmann. (2006). Graphics of Large Datasets: Visualizing a Million. New York: Springer.

Ware, Colin (2012). Information Visualization: Perception for Design. Elsevier.

Wickham, Hadley. (2009). ggplot2: Elegant Graphics for Data Analysis. New York: Springer.

Wilkinson, Leland. (2005). The Grammar of Graphics (2<sup>nd</sup> Edition). New York: Springer.