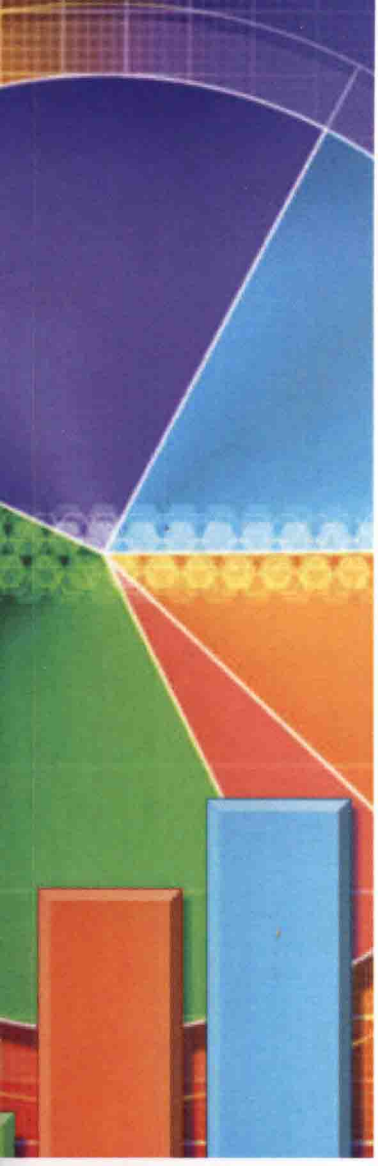

QUANTITATIVE APPROACHES TO DECISION MAKING COLLECTION
Donald N. Stengel, *Editor*

Data Visualization, Volume II

Uncovering the Hidden Pattern in Data Using Basic and New Quality Tools

Amar Sahay

BUSINESS EXPERT PRESS

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Data Visualization, Volume II

Abstract

The focus of this book is on data visualization and information visualization tools—two major categories of data visualization. The first part discusses the concepts and applications related to data analysis, visualization, and the current trend in data visualization. A discussion of systems and processes is provided as all data are collected from systems and processes. A section emphasizes the importance of variation in data analysis since almost all data show variation and the visual tools are an excellent way to study, analyze, and reduce the variation in the processes. Applications illustrate how the visual tools are an excellent means of viewing the current state of the process and provide the opportunities for improvement. The second part of the book is devoted to ***quality tools***, *a set of graphical and information visualization tools* in data analysis, decision making, and Lean Six Sigma quality programs. The key application areas of visual tools including the business process improvement, business data analysis, health care, finance, manufacturing engineering, process improvement, and product and process design are discussed. The two categories of visualization tools—**seven basic tools and seven new tools of quality**—are discussed with their applications. The basic quality tools are Process Maps, Check Sheets, Histograms, Scatter Diagrams, Run Charts, Control Charts, Cause-and-Effect (Ishikawa) Diagrams, and Pareto Charts/Analysis. The seven new tools of quality—a set of visuals used to solve quality problems using graphical and analytical techniques—include the Affinity Diagram, Interrelationship Digraph, Tree Diagram, Prioritizing Matrices, Matrix Diagram, Process Decision Program Chart, and Activity Network Diagram. Other information processing tools, such as QFD—the quality function deployment/house of quality—and multivari charts, are discussed using commonly used software.

Keywords

big data, business intelligence, charts and graphs, data, data visualization, information visualization, quality tools, seven basic tools of quality, seven new tools of quality, visual representation

Preface

The purpose of this book is to introduce the graphical tools and information visualization tools widely used in data analysis, visualization, and quality improvement to analyze, enhance, and improve the quality of products and services. Visual tools are an easy way to gain a first look at your data and they have been used to gain an insight into the data before applying more complex analysis. The book provides a collection of visuals and graphical tools. The visual tools are commonly referred to as graphical tools. A number of charts and graphs are commonly used to create visuals that provide a quick summary, trends, and patterns in the data which are not usually apparent from the data in raw form.

The first part of the book presents background information and the fundamental concepts relating to data visualization. The following concepts are covered in the first part:

- Overview and Data Visualization
- Data and Data Analysis Concepts
- Systems Processes and Variation
- Current Trends in Data Visualization
- Data Visualization Concepts and Applications

The second part of the book is devoted to ***quality tools***. *These are a set of graphical and information visualization tools* that have been developed and used over the years in quality improvement and Lean Six Sigma programs. The use of these data visualization and quality tools is not limited to quality programs. The key areas where these tools are applied include business process improvement, business data analysis, health care, finance, manufacturing, engineering process improvement, and product and process design, to name a few. These visual tools are powerful decision-making tools.

The quality tools in this text represent data visually that enable the analyst to immediately see the important features and characteristics of data. The graphs and charts provide the current state of the process and can also show the opportunities for improvement.

Some of the visual displays, for example, flow diagrams and value stream mapping, have been successfully used in studying, developing, and improving business and engineering processes. They also help to redesign more efficient processes. Besides improving the process design, many specially designed graphs and charts are used in product and process design and improvement. In many cases, these visual tools provide an idea about the variation in the process that allows the opportunity for reducing variation. Variation reduction is one of the major goals of process improvement and quality improvement. In many cases, the visual tools also help reveal the ***waste*** in the process. These graphical tools are critical in identifying waste and variation in any process. All processes—service or manufacturing—have two things in common—waste and variation. Minimizing and eliminating wastes and defects leads to a lean and defect-free process with enhanced quality. Waste and variation reduction also can significantly reduce the cost of poor quality. The quality tools in this book are problem-solving and decision-making tools that can be applied to improve the product and service quality. The data and information visualization tools discussed in this book have been successfully applied to:

- improve product and service quality,
- reduce operating cost,
- increase sales and revenue,
- reduce cycle time,
- increase reliability,
- incorporate innovation in products and services,
- increase productivity and profitability,
- reduce the variation in the processes, and
- meet or exceed customer expectations.

Many of these problems can be solved using graphical and information visualization tools leading to product and service excellence. The following are the highlights and the areas this book discusses:

- Data and data analysis concepts
- Data and information visualization
- Data visualization with big data
- Seven basic tools of quality—graphical techniques used to detect and solve problems
- The seven new tools of quality—a set of visuals used to solve quality problems using graphical and analytical techniques
- A set of useful tools in quality improvement and Lean Six Sigma that we refer to—"beyond the basic and new tools of quality"
- Information processing tools—Flow diagrams, Process Flow diagrams, SIPOC (supplier, input, process, output, and customer) diagrams, VSM (value stream mapping), and QFD (quality function deployment/house of quality matrix).

The objective is to enable one to master the visual techniques and be able to use them in detecting, solving problems, and making effective decisions.

The readers will find these tools to be extremely useful in analyzing and solving problems in areas ranging from business, finance, health care, manufacturing, quality, and Lean Six Sigma to product and process designs. These tools are easy to learn and very useful in learning about the process from which the data are collected. The understanding of these tools will enable one to draw meaningful conclusions from data. In this book, we will discuss the concepts and computer applications for these visual quality tools. We also introduce data visualization using big data.

The book presents the following concepts related to data, data visualization, and information visualization tools along with the current trends in data visualization:

- Basic concepts of data, data visualization, and graphical/visual tools
- Current trends in data visualization—introduction to business intelligence, visual analytics, and big data
- Types of data, data for research and analysis, software tools used for graphical/visual techniques

- Applications and interpretation of the graphical techniques using computer software
- Implementing the graphical and visual tools using commonly used software
- Quality tools in data analysis, quality improvement, and Lean Six Sigma projects
- Powerful tools beyond the basic and new tools of quality that include multi-vari charts, symmetry plots, and variations of scatter plots
- Data visualization applications using big data

The book will appeal to a large audience including majors in business, statistics, graduate students in business, MBAs, professional MBAs, data analysts, business process analysts, data scientists, and working people in business and industry. Managers, practitioners, professionals, quality professionals, quality engineers, and anyone involved in quality improvement, big data, data visualization, and visual analytics will find the book to be a valuable resource that can be used in learning and applying the visualization and improvement tools. The book explains the applications using a number of real-world examples and cases.

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Graphical and Visual Tools for Improving Product and Service Quality

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