

# Six Sigma is Possible with R

## And Even Better

Emilio Lopez

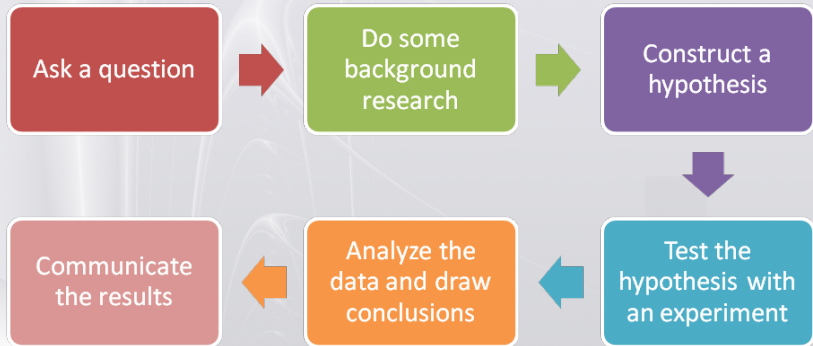
Department of Statistics and Operations Research  
Rey Juan Carlos University (Madrid)

University of Warwick, August 2011

# The DMAIC Cycle



# The Scientific Method



<http://electroncafe.wordpress.com/2011/05/04/scientific-process-rage/>

# The Scientific Method & Six Sigma

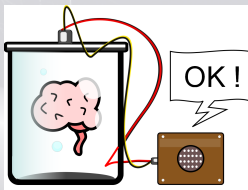
DMAIC Cycle	Scientific Method
Define	Ask a question
Measure	Do some background research
Analyze	Construct a hypothesis
Improve	Test the hypothesis with an experiment
	Analyze the data and draw conclusions
Control	Communicate results

# The key to success

*Science is organized knowledge.*

Herbert Spencer

Six Sigma is a quality paradigm which translates the complicated scientific terminology into a simple way to apply the scientific method within every organization.



# Six Sigma Software

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**Six Sigma Project Mgmt | Instantis.com**

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On-Demand **Software** for Project Tracking, Reporting & Dashboards

**List of Six Sigma software packages - Wikipedia, the free encyclopedia**

en.wikipedia.org/wiki/List\_of\_Six\_Sigma\_software\_packages - Cached

There are generally four classes of **software** used to support **Six Sigma**: Analysis tools, which are used to perform statistical or process analysis ...

**Six Sigma for Software**

www.e-p-o.com/Bibliografia/SixSigmaForSoftware.pdf

File Format: PDF/Adobe Acrobat - Quick View

by TM Fehlmann - Cited by 5 - Related articles

**software**, and ICT? **Six Sigma** is about cost reduction by eliminating defects. ... Applying **Six Sigma** to **software** development makes **software** projects ...

**Six Sigma Software - Lean Six Sigma Software - Design for Six ...**

www.nextsigma.com/ - Cached

**Six Sigma Software**, Lean Sigma Software, and Design for **Six Sigma software** by NextSigma.

**Software for Statistics, Process Improvement, Six Sigma, Quality ...**

www.minitab.com/ - Cached

Statistical and Process Management **Software** for **Six Sigma** and Quality Improvement.

**PS&J Software Six Sigma**

www.softwaresixsigma.com/ - Cached

14 Jul 2011 - Management consulting and training for **software** process improvement. We use our extensive experience in CMM, PSP, TSP and the application of ...

**Six Sigma Software Solutions | StatSoft**

www.statsoft.com/solutions/six-sigma/ - Cached

STATISTICA **Six Sigma Software** by StatSoft is an analytic software platform for Six Sigma programs and implementations of any size.

**Software | Excel Add-in for Statistical ...**

Ads

**Quality Control Software**

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**Lean Project Management**

www.visionproject.se

Web based tool for Lean Projects

www.google.es/ack?sa=Blas=ChfngOKD-TuDICMFL-AbbmznzA92BvOIEH2-a1Rr1-brORQgA...

# Six Sigma Software



WIKIPEDIA  
The Free Encyclopedia

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## List of Six Sigma software packages

From Wikipedia, the free encyclopedia



This article **does not cite any references or sources**. Please help improve this article by adding citations to reliable sources. Material may be challenged and removed. (October 2009)

It has been suggested that this article or section be merged into Six Sigma.

There are generally four classes of software used to support **Six Sigma**:

- Analysis tools, which are used to perform statistical or process analysis
- Program management tools, used to manage and track a corporation's entire Six Sigma program
- DMAIC and Lean online project collaboration tools for local and global teams
- Data Collection tools that feed information directly into the analysis tools and significantly reduce the time

### Analysis tools

#### Proprietary Software:

- Actuate
- Aeolus
- Arena (software)
- ARIS Six Sigma
- ARM - Strategic Thought Group
- @RISK for Six Sigma
- CHARTrunner by PQ Systems
- DataLyzr Spectrum
- DOE Pro XL
- EngineRoom by MoreSteam
- IBM WebSphere Business Modeler
- iGrafx Process for Six Sigma
- i-nexus
- JMP
- Oracle Crystal Ball
- Microsoft Visio
- Minitab

- Minitab
- Nimbus Control
- QI MACROS
- QPR ProcessGuide by QPR Software
- Quality Companion by Minitab
- Quality Tools Charts Generator QTcharts
- Quality Window by Busitech
- Quantum XL
- QWXL 3 by Busitech
- Quik Sigma Professional by Promontory Management Group
- SDI Tools
- SigmaFlow
- Sigma Magic
- SigmaXL
- Software AG webMethods BPM Suite
- SPC XL
- Statgraphics
- STATISTICA
- TalkFreely LTD
- Telelogic System Architect
- Select Architect Business Process Modeling

#### Open Source Software:

#### DMAIC/Lean Online Collaboration Tools

- SigmaFlow Integrated, Project Management Tools (PPM), (BPA) and (ECM)
- Groupiter SigmaSense
- TalkFreely LTD
- Quality Tools Charts Generator QTcharts

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# R Challenges

## Why Not

- Six Sigma uses Statistics.
- Six Sigma is based in the Scientific Method.
- Six Sigma should use R!

## Outstanding advantages

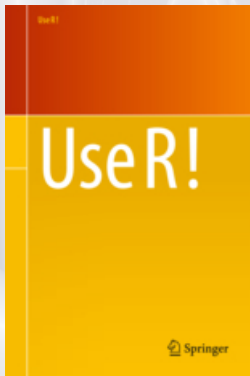
- Every Statistical Tool even in base installation
- Extending possibilities
- Powerful graphics





# Packages

- qcc** Shewhart quality control charts for continuous, attribute and count data
- IQCC** Builds statistical control charts with exact limits for univariate and multivariate cases.
- qualityTools** This is a package for teaching statistical methods in the field of Quality Science [...] The focus is on teaching [...]
- SixSigma** Our effort for spreading the R thinking along Six Sigma practitioners.

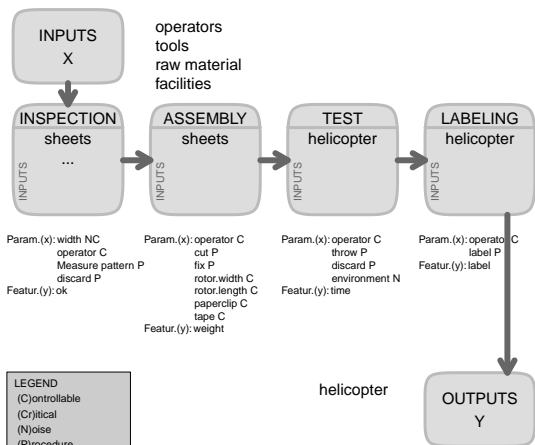


## Features

- Title:  
*Six Sigma with R*
- Due 2012
- 350 pages approx.
- Wide background scope
- Examples, a Case Study and practices

# Process Map

## Six Sigma Process Map



Paper Helicopter Project

## Six Sigma Gage R&R Study

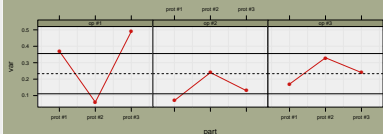
Components of Variation



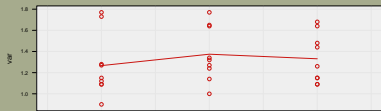
Var by Part



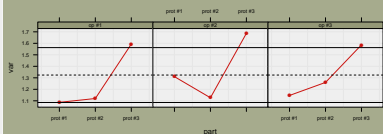
R Chart by appraiser



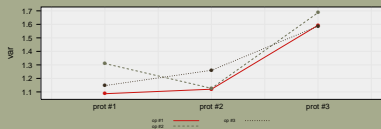
Var by appraiser



X Chart by appraiser



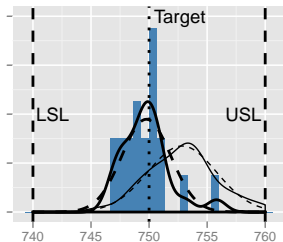
Part\*appraiser Interaction



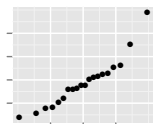
Helicopter Project

# Capability Analysis

## Six Sigma Capability Analysis Study



Check Normality



Shapiro-Wilk Test  
p-value: 0.07506

Lilliefors (K-S) Test  
p-value: 0.2291

Normality accepted when p-value > 0.05

### Density Lines Legend

	Density ST
	Theoretical Dens. ST
	Density LT
	Theoretical Density LT

### Specifications

LSL: 740  
Target: 750  
USL: 760

Short Term **Process** Long Term

Mean: 749.7625 Mean: 752.8443

SD: 2.1042 SD: 2.9577

n: 20 n: 40

Z<sub>s</sub>: 3.14 Z<sub>s</sub>: 2.42

DPMO:

Short Term **Indices** Long Term

C<sub>p</sub>: 1.5841 P<sub>p</sub>: 1.1270

Ct: [1.1,2.1] Ct: [0.9,1.4]

C<sub>pk</sub>: 1.5465 P<sub>pk</sub>: 0.8065

Ct: [1.1,2.1] Ct: [0.9,1.4]

Winery Project

# Open Platform for Quality Methodologies

## Open Platform for Quality Methodologies

- Improving the European Factory
- FP7 PPP Funding Scheme
- Looking for Partners

## Other Projects

We are available for other projects that need partners in this area



# Conclusion

## Thanks

We hope we will be able to convince Six Sigma practitioners that not only is it possible with R, but it is BETTER with R.



@emilopezcano | emilio.lopez@urjc.es