MoreSteam.com

Experimental Design in the Transactional Arena

Smita Skrivanek

April 14, 2011

Agenda

- Welcome to the Spring Series
- Introduction of MBB Webcast Series
  - Larry Goldman, MoreSteam.com
- Experimental Design in the Transactional Arena
  - Smita Skrivanek, MoreSteam.com
- Open Discussion & Questions

MoreSteam.com – Company Background

- Founded 2000
- Over 300,000 Lean Six Sigma professionals trained
- Serving 45% of the Fortune 500
- First firm to offer the complete Black Belt curriculum online
- Courses reviewed and approved by ASQ
- Registered education provider of Project Management Institute (PMI)

Select Customers:

Master Black Belt Program

- Offered in partnership with Fisher College of Business at The Ohio State University
- Employs a Blended Learning model with world-class instruction delivered in both the classroom and online
- Covers the MBB Body of Knowledge, topics ranging from advanced *DOE* to *Leading Change* to *Finance for MBBs*
- Go to http://www.moresteam.com/master-black-belt.cfm for more information about curriculum, prerequisites, and schedule

Today's Presenter

Smita Skrivanek

Principal Statistician, MoreSteam LLC

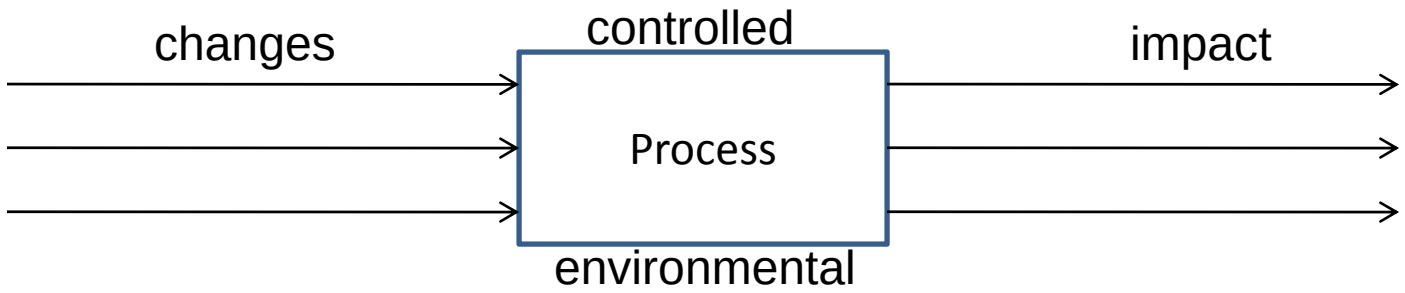
- Develops content, software functions, exam question banks and simulation games for MoreSteam's diverse client base
- EngineRoom® Product Manager
- Masters in Applied Statistics from The Ohio State University and a MS from Mumbai University, India

Objectives

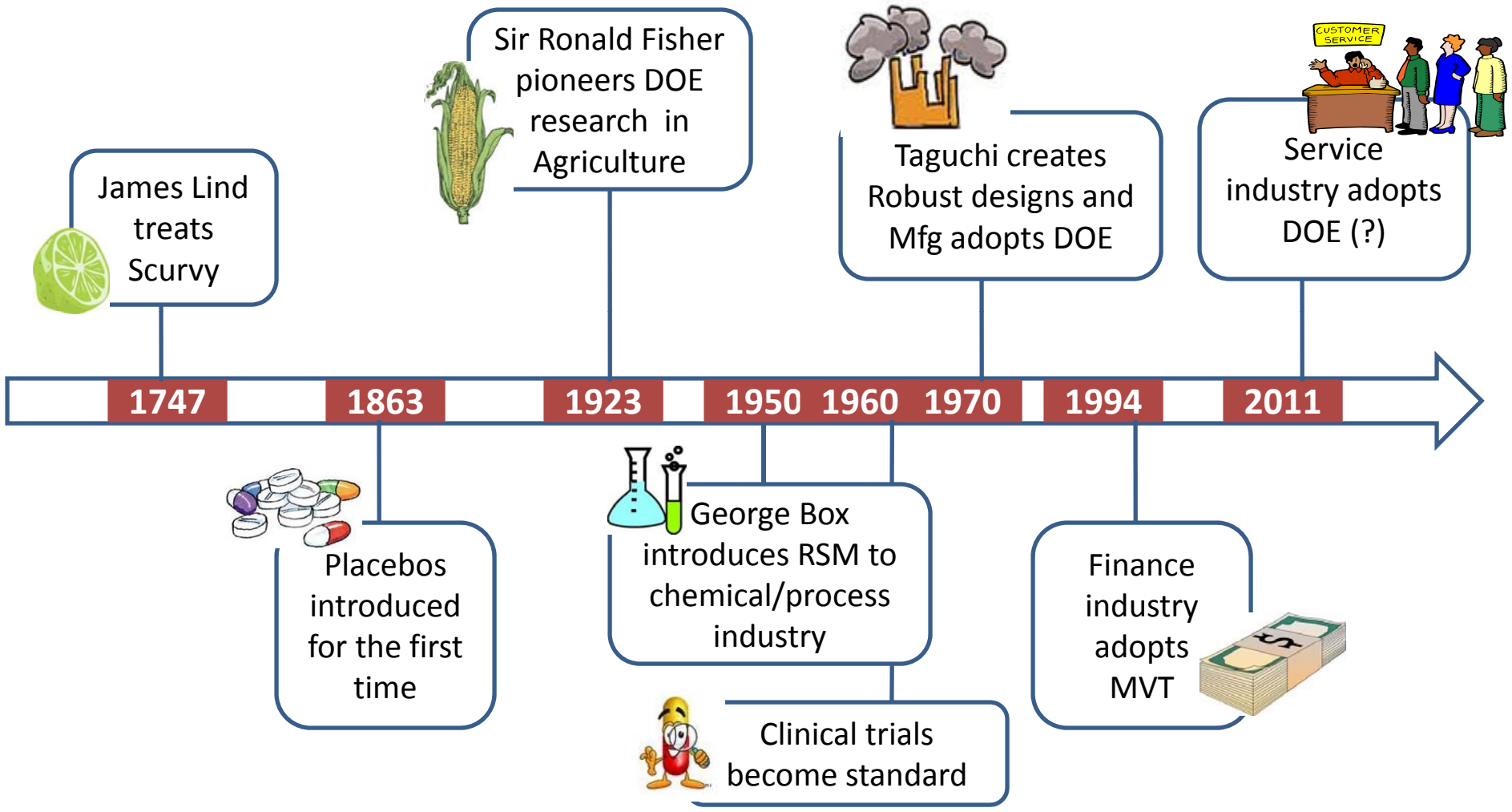
- Definition of DOE
- A brief history of DOE
- The case for using DOE in service situations
- Challenges for services-based businesses
- Some DOE Applications in the field
- An example
- Is DOE right for me/Overcoming the challenges
- Your questions

Definition of DOE

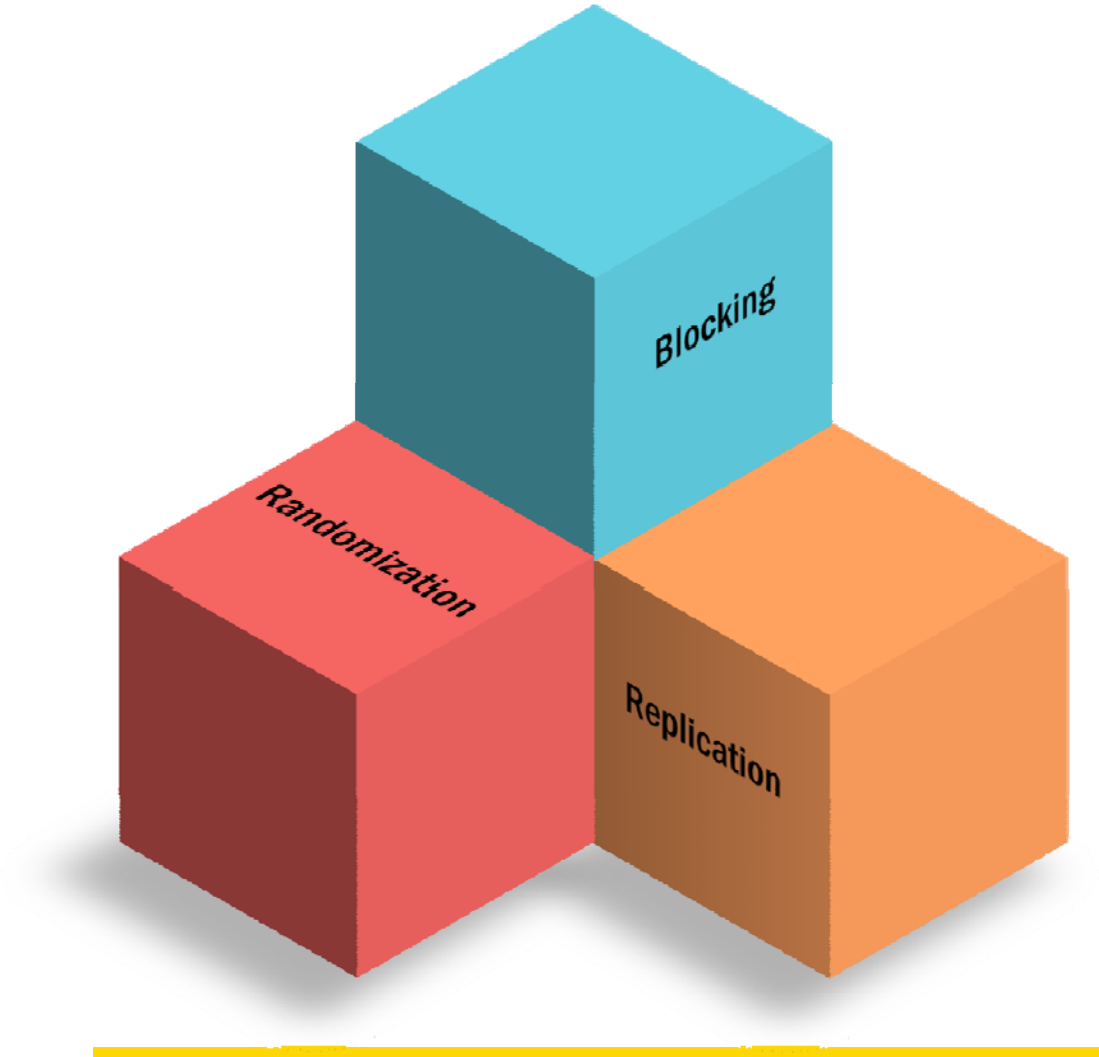
Design of experiments is a statistical technique that involves the introduction of purposeful and carefully planned changes to a process, while controlling for other factors, with the goal of measuring the impact of those changes on the process output.



A Brief History of DOE



The Building Blocks of DOE



- Prospective study
- Pre-defined protocol
- Orthogonality
- Reproducibility
- Control and feedback

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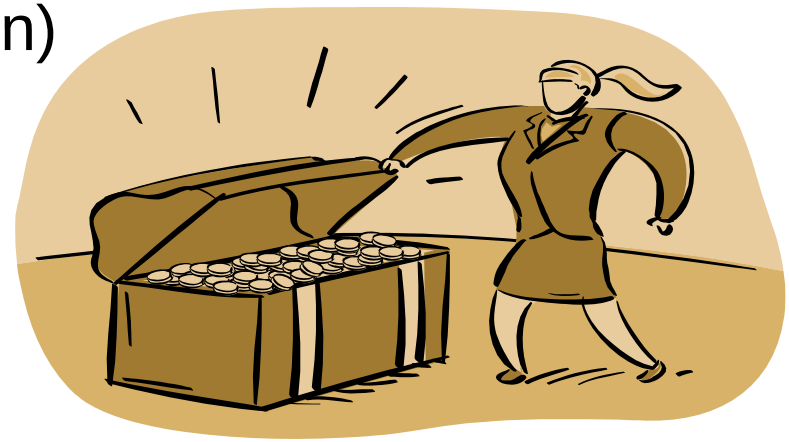
Why DOE?

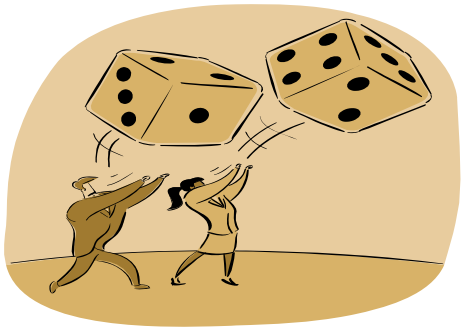
- Better than best-guess or OFAT (One-Factor-at-A-Time)
- Efficiency (More with less)
- Internal validity (Causation)
- External validity (Generalization)



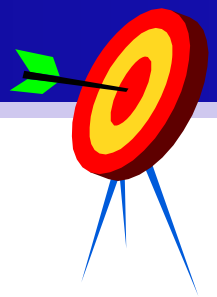
Challenges for Business

- Lack of Knowledge/Training
- Management biases
- Culture/Communication

- Practical Issues: hard-to-change factors, time effects, randomization/replication difficult
- Legal/Ethical issues
- Cost/Control/Applicability

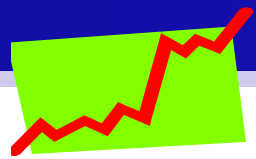


DOE Applications to Services



- Maximize customer response to marketing offers
- Customer complaint correction process: reduce the response time to failures
- Effects of different Web site design factors on conversion rates for an e-commerce site
- Marketing mix planning: effects of price, promotion and display on sales
- Effects of changes in staffing, training levels, procedures and system design on service quality and effectiveness

More Applications of DOE



- Determine how the amount of supervisor coaching, group management practices and process automation affect employee performance over time
- Administration: Minimize errors in the order filling process
- Healthcare: Investigating the causes for emergency room wait times
- Education: student learning based on use of computers, peer coaching & homework burden
- Employment: how certain resume features (# pages, keywords) influence acceptance rates.

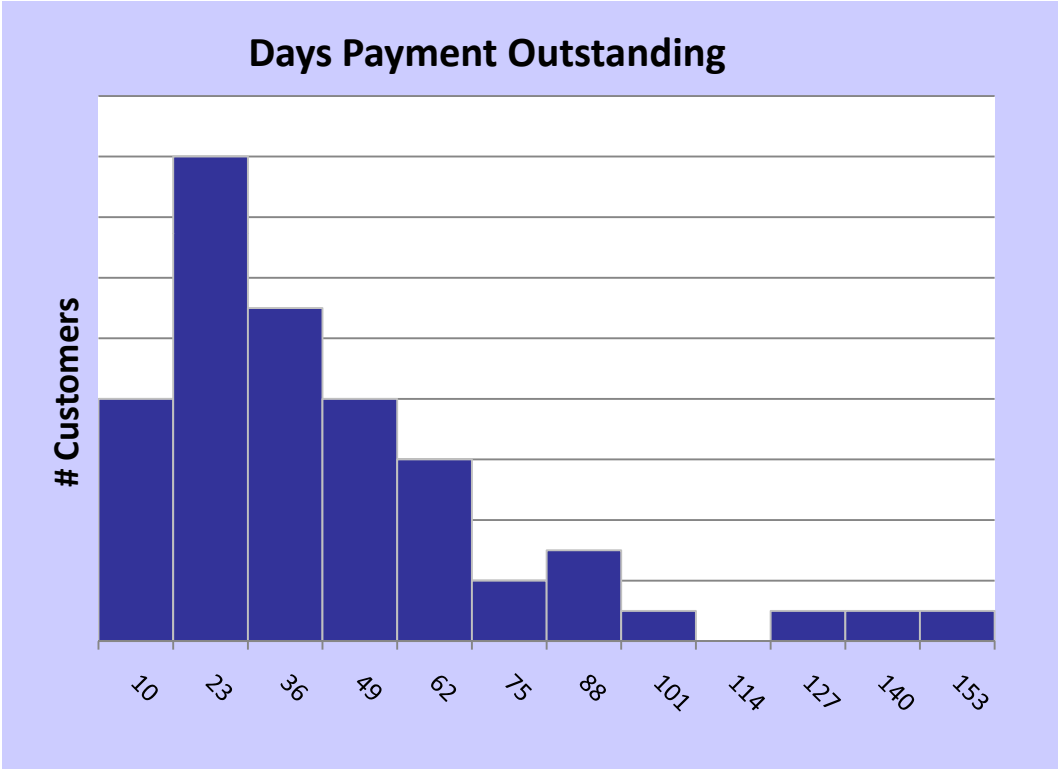
Case Study: Days Payment Outstanding

A medium-sized business that provides Business-to-Business services was experiencing a serious receivables management problem.

- Days payment outstanding (DPO) was through the roof, up to 150 days in some cases.
- $$$ being conceded due to age out.
- Product performance, order processing, contracts and terms, Billing, Collection checked.

Case Study: Days Payment Outstanding

Objective: Minimize Days Payment Outstanding (DPO)



Case Study: Days Payment Outstanding

Response: Days Payment Outstanding (DPO)

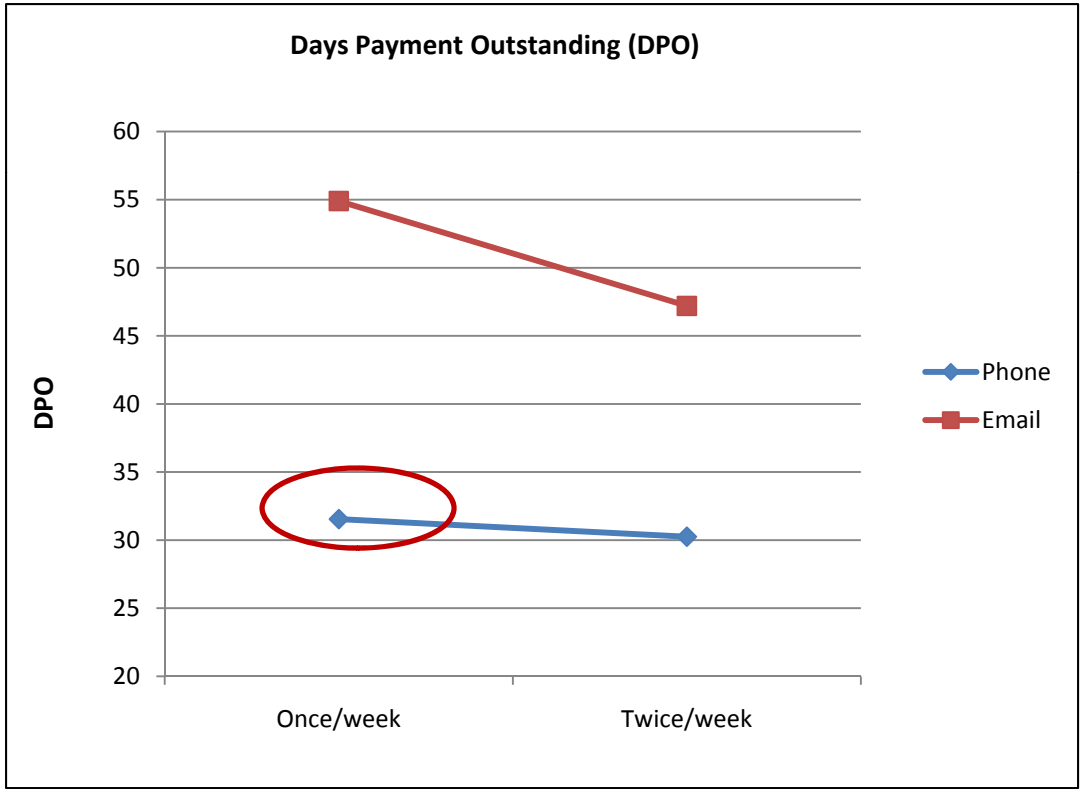
	Levels	
Factors	**Low (-)**	**High (+)**
Medium of Contact	Phone	Email
Frequency	Once/week	Twice/week

Design: 2-level full factorial with two factors (2^2)

Duration: 24 weeks, 40 customer orders
(10 replicates)

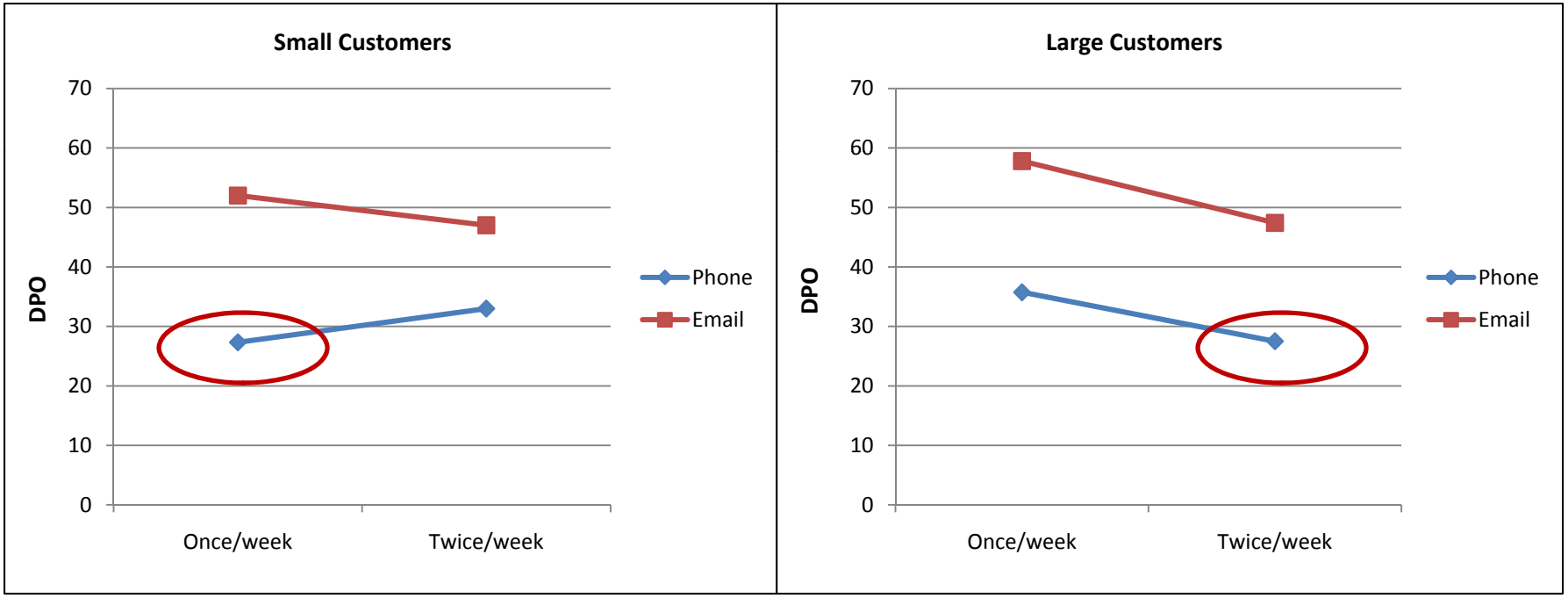
Days Payment Outstanding: Analyzing the Data

Response: Days Payment Outstanding (DPO)



Days Payment Outstanding: Analyzing the Data

Sometimes it helps to slice the data…..



Days Payment Outstanding: Analyzing the Data

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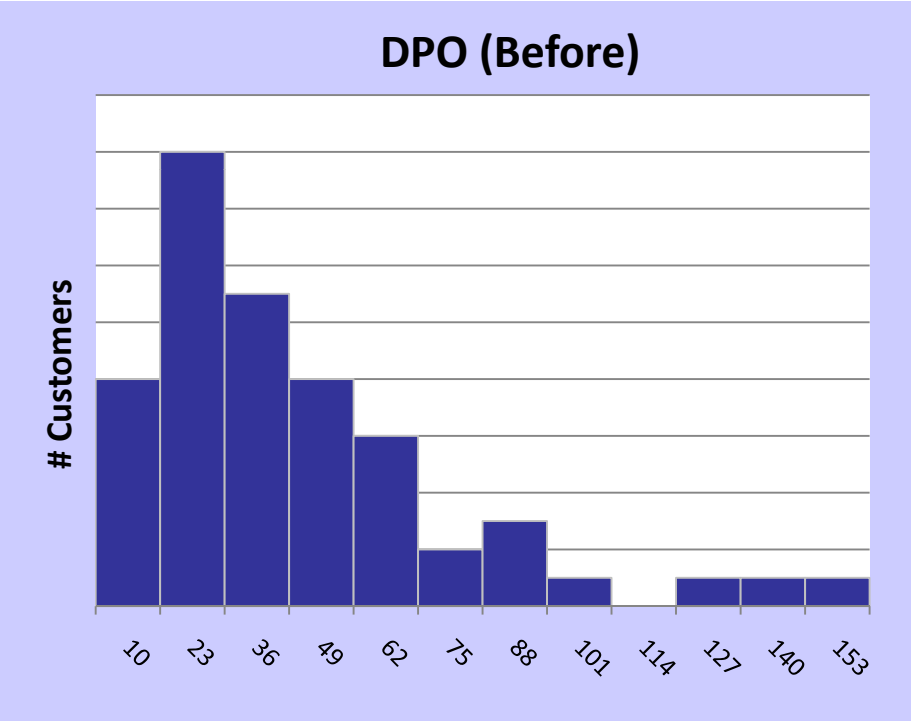

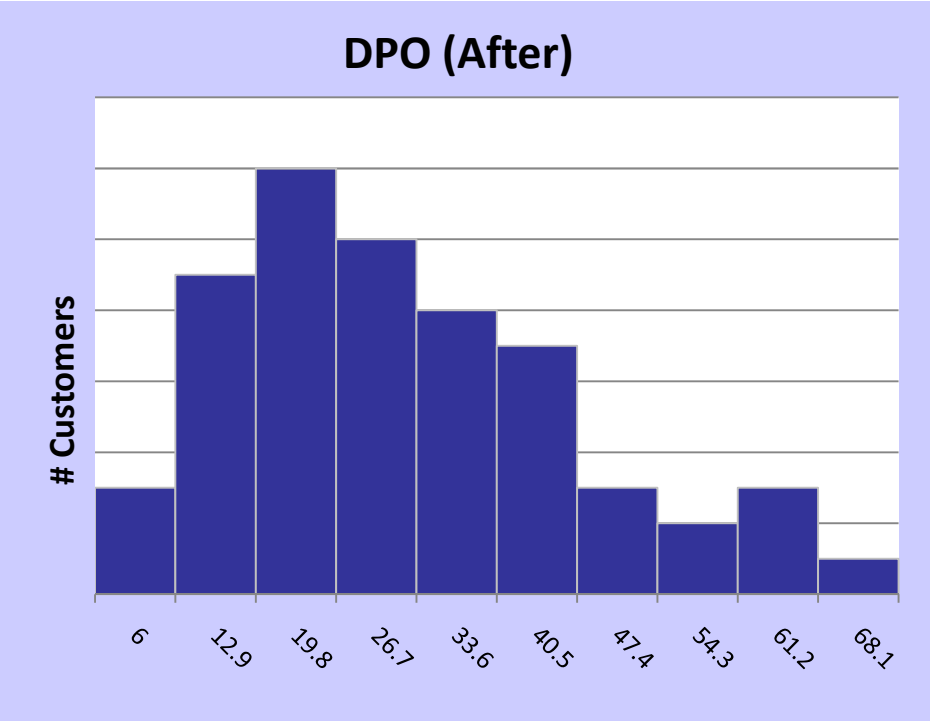

DPO: Results

Large Customers	Small Customers
• Median DPO reduced by 34%	• Median DPO reduced by 20%
• Contact by phone	• Contact by phone
• Twice a week	• Once a week

Over the next 6 months, the reduction in overall Days Payment Outstanding made a significant improvement to receivables, resulting in an addition of $1.2 M to the bottom line.

Is DOE right for me?

- You have a clearly communicated business need.
- You can state the problem as a logical hypothesis that can be tested through experimentation.
- Problem represents tactical decisions (Method A or B?), not strategic issues (Diversify or not?)
- You have management backing.
- The outcome variable is defined and measurable.
- You can truly control the independent variables.
- Sufficient, roughly homogenous ‘units’ are available.
- You have sufficient time to implement the experiment.

Overcoming the Challenges

Challenge	Possible Solution
• Hard to change factors	• Split plot experiments
• Randomization not possible	• Change experimental unit
• Randomization not possible	• Quasi-experimental design
• Factor levels are general	• Random/Mixed effects design
• Multiple known sources of variation	• Latin Square design
• Small sample size	• Use a descriptive study (no causal inferences!)

Further Reading

- Design and Analysis of Experiments, 7th Edition – Douglas Montgomery
- Statistics for Experimenters – Box, Hunter, Hunter
- Testing 1 - 2 - 3: Experimental Design with Applications in Marketing and Service Operations – Ledolter, Swersey

So Finally….

References

- *Research Methods in Management: A concise introduction to research in management and business consultancy* - Geoff Lancaster; Butterworth-Heinemann (January 13, 2005)
- *How to Design Smart Business Experiments* – Thomas H. Davenport, Harvard Business Review, February 2009
- *Statistics for Experimenters: Design, Innovation, and Discovery, 2nd Ed*. – George Box, Stuart Hunter, William Hunter, John Wiley & Sons, Inc, 2005.
- *Testing 1 - 2 - 3: Experimental Design with Applications in Marketing and Service Operations* - Johannes Ledolter, Arthur Swersey, Stanford Business Books
- *Practical Guide to Controlled Experiments on the Web: Listen to Your Customers not to the HiPPO* - Ron Kohavi, Randal M. Henne, Dan Sommerfield, KDD 2007
- *Boost Your Marketing ROI* – Eric Almquist, Gordon Wyner, Harvard Business Review, October 2001
- *Multivariate Data Analysis 6th Ed*., Joseph F. Hair, Jr., William C. Black, Barry J. Babin, Rolph E. Anderson, Ronald L. Tatham (2006)

Thank you for joining us

Resource Links and Contacts

Questions? Comments? We'd love to hear from you.

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Additional Resources

Next Webcast: "Negotiating Your Way to Success," Dr. Roy J. Lewicki , Fisher College of Business, The Ohio State University, Thur., April 28 @1:00 PM (EDT)
http://www.moresteam.com/presentations/webcast-negotiation.cfm

Master Black Belt Program: http://www.moresteam.com/master-black-belt.cfm