Business Value of
Agile Methods

Using ROI & Real Options

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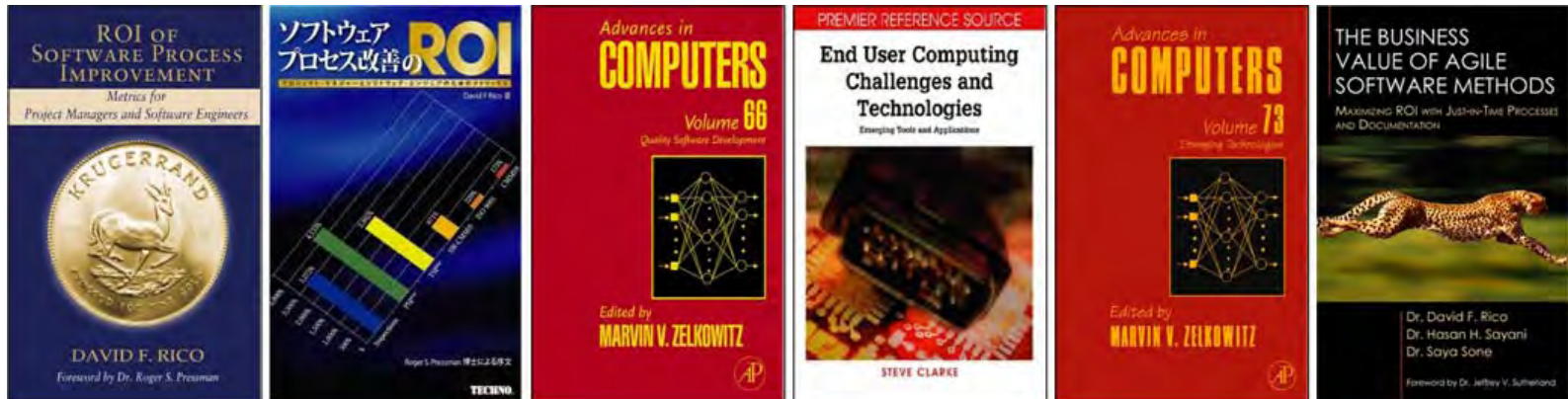
Author

- DoD contractor with 28+ years of IT experience
- B.S. Comp. Sci., M.S. Soft. Eng., & D.M. Info. Sys.
- <u>Large gov't projects in U.S., Far/Mid-East, & Europe</u>

→ *Published six books & numerous journal articles*
→ *Adjunct at George Washington, UMUC, & Argosy*
→ *<u>Agile Program Management & Lean Development</u>*
→ *Specializes in metrics, models, & cost engineering*
→ *Six Sigma, CMMI, ISO 9001, DoDAF, & DoD 5000*
→ *Cloud Computing, SOA, Web Services, FOSS, etc.*

Agenda

☞ **INTRO to Agile Methods**

Types of Agile Methods

Practices of Agile Methods

Studies of Agile Methods
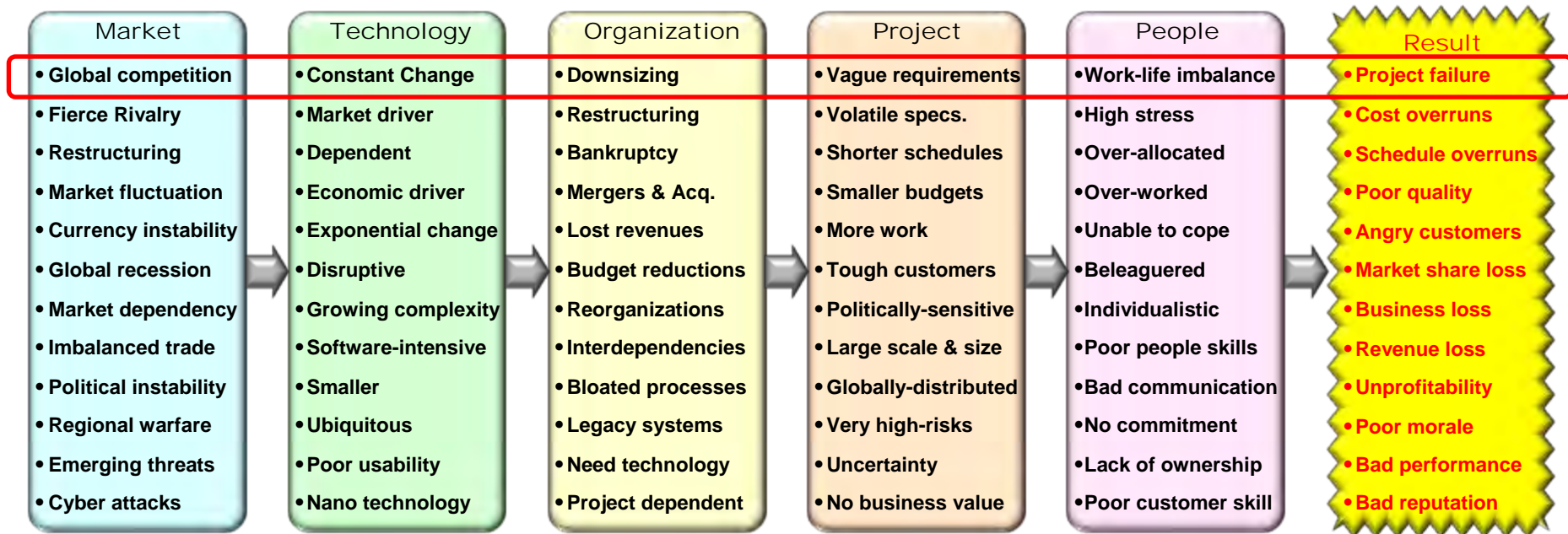
Cost & Benefits of Agile Methods

Business Value of Agile Methods

Comparison of Agile Methods

Summary of Agile Methods

Today's Environment

- ☐ Highly-unstable global and domestic markets
- ☐ Customers are demanding and difficult to please
- ☐ Project plans cannot cope with this level of volatility

Market	Technology	Organization	Project	People	Result
• Global competition	• Constant Change	• Downsizing	• Vague requirements	• Work-life imbalance	• Project failure
• Fierce Rivalry	• Market driver	• Restructuring	• Volatile specs.	• High stress	• Cost overruns
• Restructuring	• Dependent	• Bankruptcy	• Shorter schedules	• Over-allocated	• Schedule overruns
• Market fluctuation	• Economic driver	• Mergers & Acq.	• Smaller budgets	• Over-worked	• Poor quality
• Currency instability	• Exponential change	• Lost revenues	• More work	• Unable to cope	• Angry customers
• Global recession	• Disruptive	• Budget reductions	• Tough customers	• Beleaguered	• Market share loss
• Market dependency	• Growing complexity	• Reorganizations	• Politically-sensitive	• Individualistic	• Business loss
• Imbalanced trade	• Software-intensive	• Interdependencies	• Large scale & size	• Poor people skills	• Revenue loss
• Political instability	• Smaller	• Bloated processes	• Globally-distributed	• Bad communication	• Unprofitability
• Regional warfare	• Ubiquitous	• Legacy systems	• Very high-risks	• No commitment	• Poor morale
• Emerging threats	• Poor usability	• Need technology	• Uncertainty	• Lack of ownership	• Bad performance
• Cyber attacks	• Nano technology	• Project dependent	• No business value	• Poor customer skill	• Bad reputation

Augustine, S. (2005). *Managing agile projects*. Upper Saddle River, NJ: Pearson Education.

Chin, G. (2004). *Agile project management*: *How to succeed in the face of changing project requirements*. Broadway, NY: Amacom.

DeCarlo, D. (2004). *Extreme project management*: *Using leadership, principles, and tools to deliver value in the face of volatility*. San Francisco, CA: Jossey-Bass.
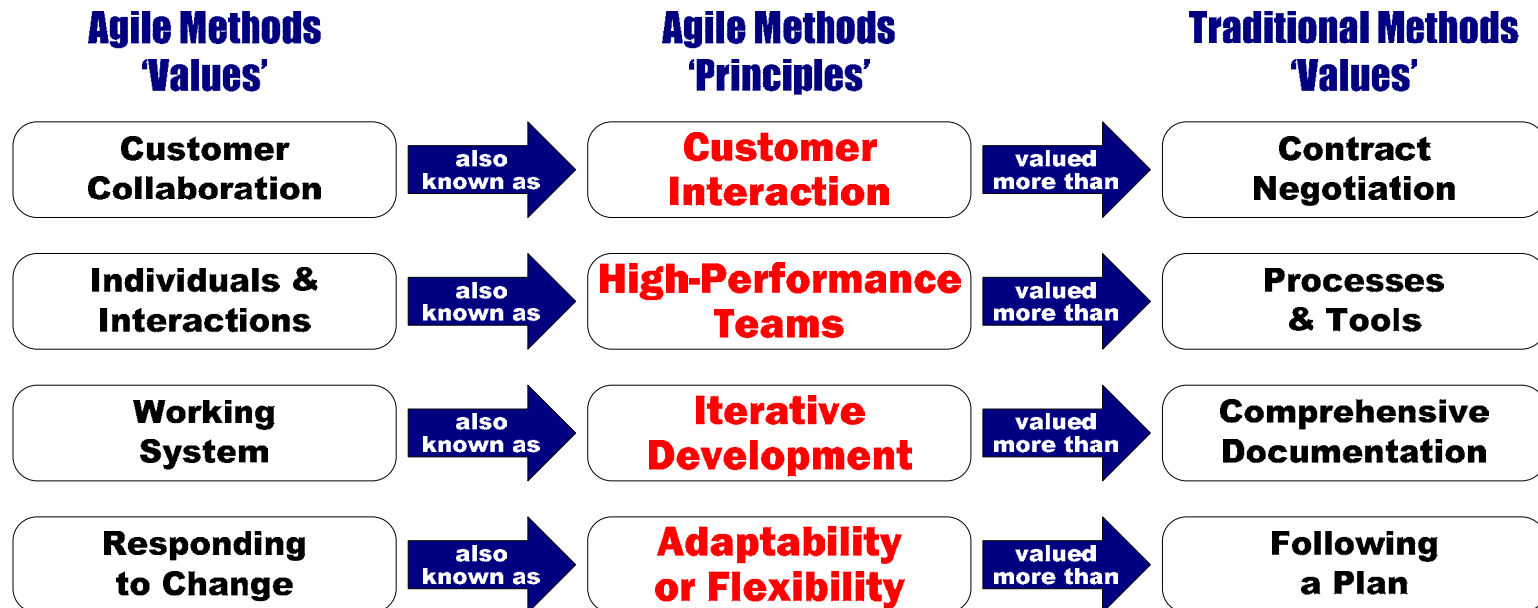
Highsmith, J. A. (2010). *Agile project management*: *Creating innovative products*. Boston, MA: Pearson Education.

Need for a New Model

- ☐ Need for a new model of project management
- ☐ Cope with high-level of uncertainty and ambiguity
- ☐ <u>With just the right balance of flexibility and discipline</u>

R&D Oriented	People Centered	Adaptive	Customer Friendly	Fast & Efficient	Disciplined
• Innovation centered	• Highly-talented teams	• New customer needs	• Customer responsive	• Lightweight process	• Rigorous quality
• Complex problems	• Cross-functional	• Market threats	• Freq. communication	• Quick decisions	• Lightweight plans
• One-off systems	• Small team size	• Global threats	• Customer demos	• Iterative delivery	• Lightweight lifecycles
• Vague requirements	• Freq. communication	• Changing scope	• Customer feedback	• Frequent deliveries	• Security engineering
• Incomplete info.	• Interpersonal trust	• Changing technology	• Business value focus	• Fast delivery	• Light requirements
• High uncertainty	• Rich collaboration	• Changing regulations	• Customer satisfaction	• Short timelines	• Light architecture
• Experimentation	• Empowered decisions	• Continuous change	• Customer interaction	• Fast time-to-market	• Lightweight design
• Simulations	• Sustainable pace	• Flexible culture	• Customer sensitivity	• First-mover capability	• Code reviews
• Prototyping	• Daily interaction	• Flexible attitudes	• Customer relations	• Minimal process cost	• Rigorous V&V
• New discoveries	• Rich communications	• Flexible policies	• Customer contact	• Low work-in-process	• Rigorous CM
• New products	• Face-to-face	• Flexible processes	• Customer involved	• Flexible processes	• Rigorous QA
• Creative solutions	• Cohesiveness	• Flexible technologies	• Customer driven	• Market responsive	• Project reviews

Augustine, S. (2005). *Managing agile projects*. Upper Saddle River, NJ: Pearson Education.

Chin, G. (2004). *Agile project management*: *How to succeed in the face of changing project requirements*. Broadway, NY: Amacom.

DeCarlo, D. (2004). *Extreme project management*: *Using leadership, principles, and tools to deliver value in the face of volatility*. San Francisco, CA: Jossey-Bass.

Highsmith, J. A. (2010). *Agile project management*: *Creating innovative products*. Boston, MA: Pearson Education.

What is Agility?

- **A-gil-i-ty** (ə-ˈji-lə-tē) Quickness, lightness, and ease of movement; To be very nimble
  - *The ability to create and respond to change in order to profit in a turbulent global business environment*
  - *The ability to quickly reprioritize use of resources when requirements, technology, and knowledge shift*
  - *A very fast response to sudden market changes and emerging threats by intensive customer interaction*
  - *Use of evolutionary, incremental, and iterative delivery to converge on an optimal customer solution*
  - *Maximizing the business value with right-sized, just-enough, and just-in-time processes and documentation*

What are Agile Methods?

- ☐ People centric way to create innovative solutions
- ☐ Market centric model to maximize business value
- ☐ Alternative to large document based methodologies

Agile Methods 'Values'		Agile Methods 'Principles'		Traditional Methods 'Values'
Customer Collaboration	also known as →	**Customer Interaction**	valued more than →	Contract Negotiation
Individuals & Interactions	also known as →	**High-Performance Teams**	valued more than →	Processes & Tools
Working System	also known as →	**Iterative Development**	valued more than →	Comprehensive Documentation
Responding to Change	also known as →	**Adaptability or Flexibility**	valued more than →	Following a Plan

Agile Manifesto. (2001). *Manifesto for agile software development*. Retrieved September 3, 2008, from http://www.agilemanifesto.org

Lean & Agile Intersection

- ☐ Agile is naturally lean and based on small batches
- ☐ Agile directly supports six principles of lean thinking
- ☐ <u>Agile may be converted to a continuous flow system</u>

Agile Values	Lean Pillars	Lean Principles	Lean & Agile Practices	Flow Principles
Empowered Teams	Respect for People	Relationships	• Customer relationships, satisfaction, trust, and loyalty • Team authority, empowerment, and resources • Team identification, cohesion, and communication	Decentralization
		Customer Value	• Product vision, mission, needs, and capabilities • Product scope, constraints, and business value • Product objectives, specifications, and performance	Economic View
Customer Collaboration		Value Stream	• As is policies, processes, procedures, and instructions • To be business processes, flowcharts, and swim lanes • Initial workflow analysis, metrication, and optimization	WIP Constraints & Kanban
Iterative Delivery	Continuous Improvement	Continuous Flow	• Batch size, work in process, and artifact size constraints • Cadence, queue size, buffers, slack, and bottlenecks • Workflow, test, integration, and deployment automation	Control Cadence & Small Batches
		Customer Pull	• Roadmaps, releases, iterations, and product priorities • Epics, themes, feature sets, features, and user stories • Product demonstrations, feedback, and new backlogs	Fast Feedback
Responding to Change		Perfection	• Refactor, test driven design, and continuous integration • Standups, retrospectives, and process improvements • Organization, project, and process adaptability/flexibility	Manage Queues/ Exploit Variability

Womack, J. P., & Jones, D. T. (1996). *Lean thinking*: *Banish waste and create wealth in your corporation*. New York, NY: Free Press.

Reinertsen, D. G. (2009). *The principles of product development flow*: *Second generation lean product development*. New York, NY: Celeritas.

Reagan, R. B., & Rico, D. F. (2010). *Lean and agile acquisition and systems engineering*: *A paradigm whose time has come*. DoD AT&L Magazine, 39(6).

Agenda

Intro to Agile Methods

☞ **TYPES of Agile Methods**

Practices of Agile Methods

Studies of Agile Methods

Cost & Benefits of Agile Methods

Business Value of Agile Methods

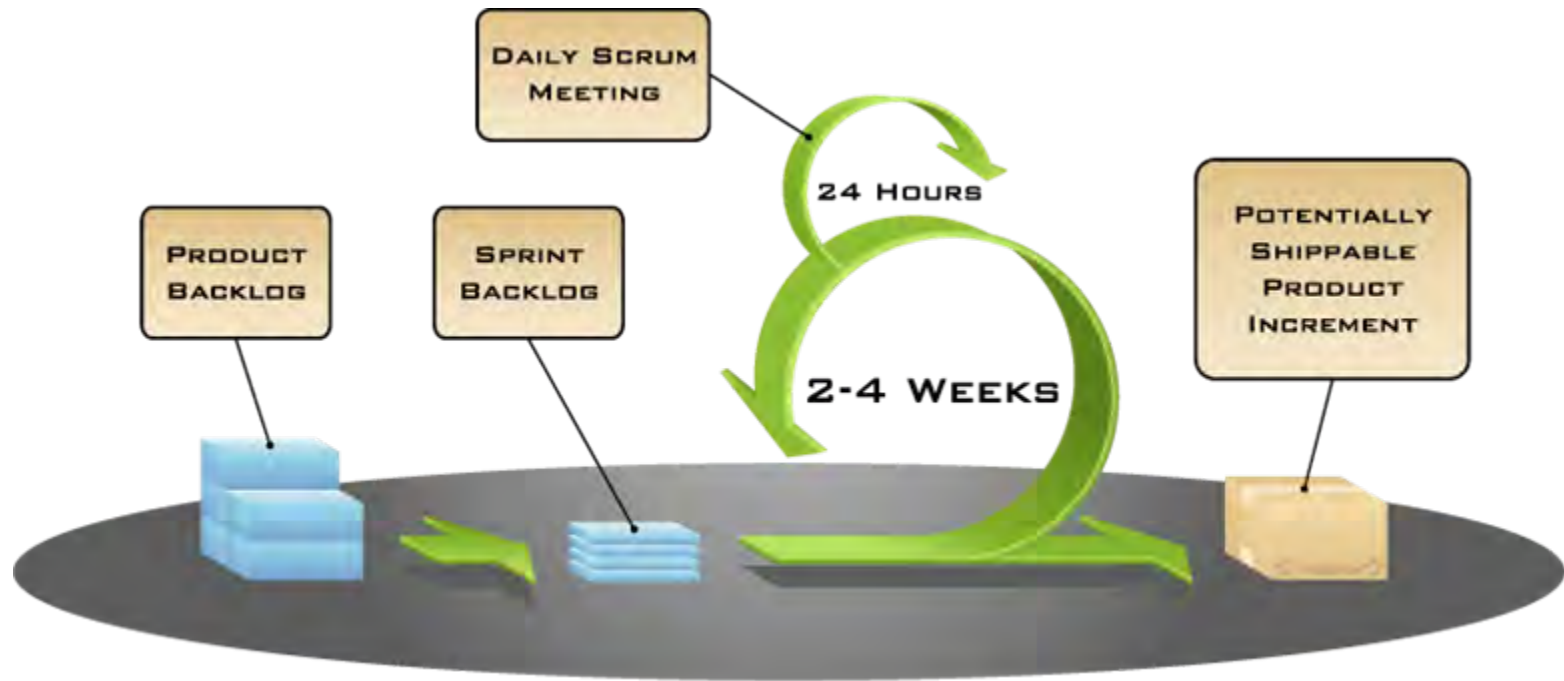Comparison of Agile Methods

Summary of Business Value

Crystal Methods

- Created by Alistair Cockburn in 1991
- Has 14 practices, 10 roles, and 25 products
- Scalable family of techniques for critical systems

Cockburn, A. (2002). *Agile software development*. Boston, MA: Addison-Wesley.
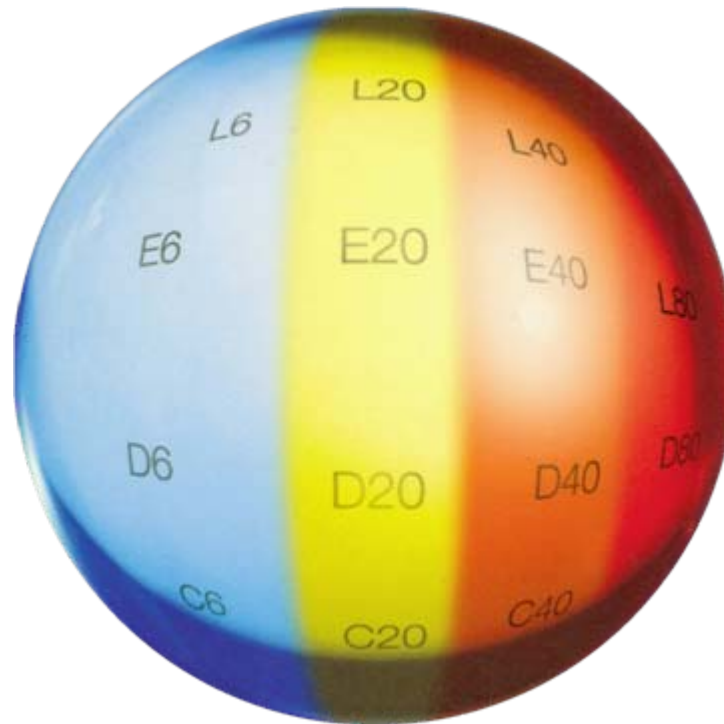
Scrum

- Created by Jeff Sutherland at Easel in 1993
- Has 5 practices, 3 roles, 5 products, rules, etc.
- <u>Uses EVM to burn down backlog in 30-day iterations</u>

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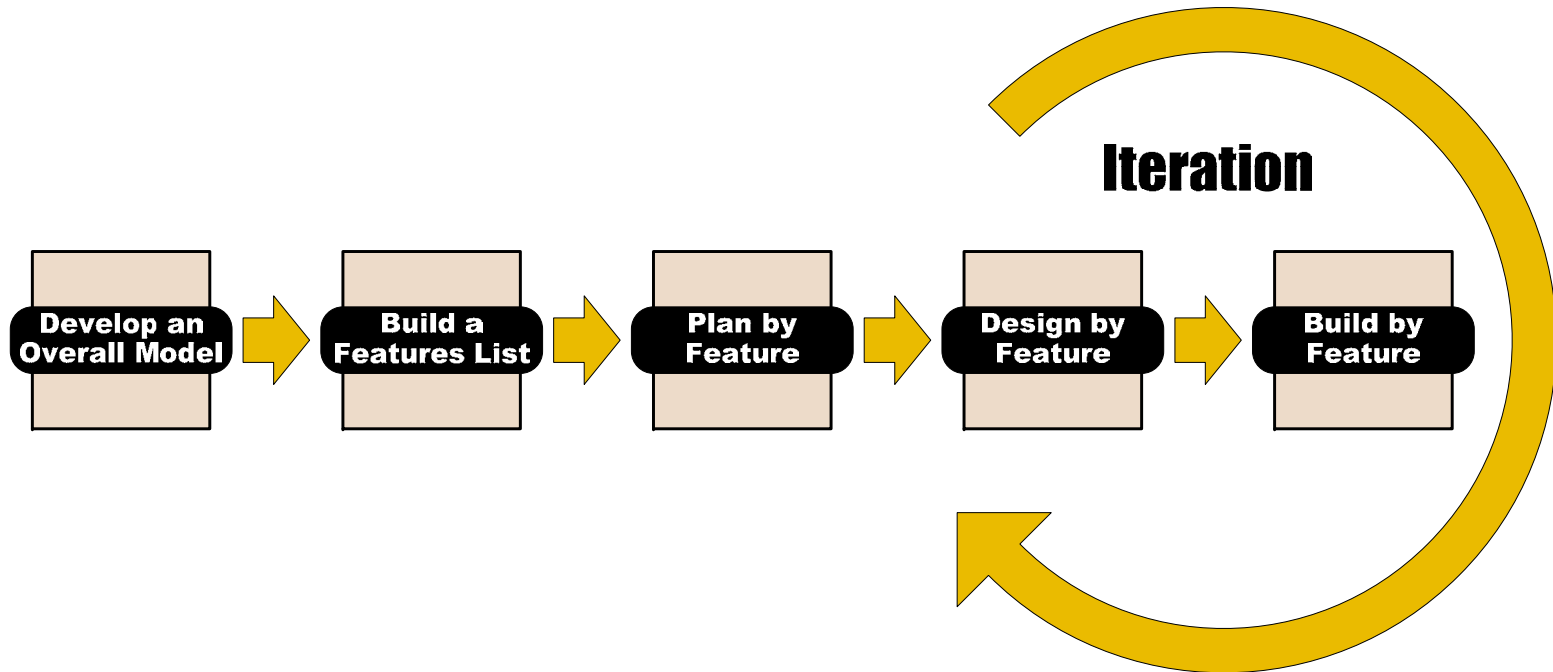Schwaber, K., & Beedle, M. (2001). *Agile software development with scrum*. Upper Saddle River, NJ: Prentice-Hall.

Dynamic Systems Develop.

- ☐ Created by group of British firms in 1993
- ☐ 15 practices, 12 roles, and 23 work products
- ☐ <u>Non-proprietary RAD approach from early 1990s</u>
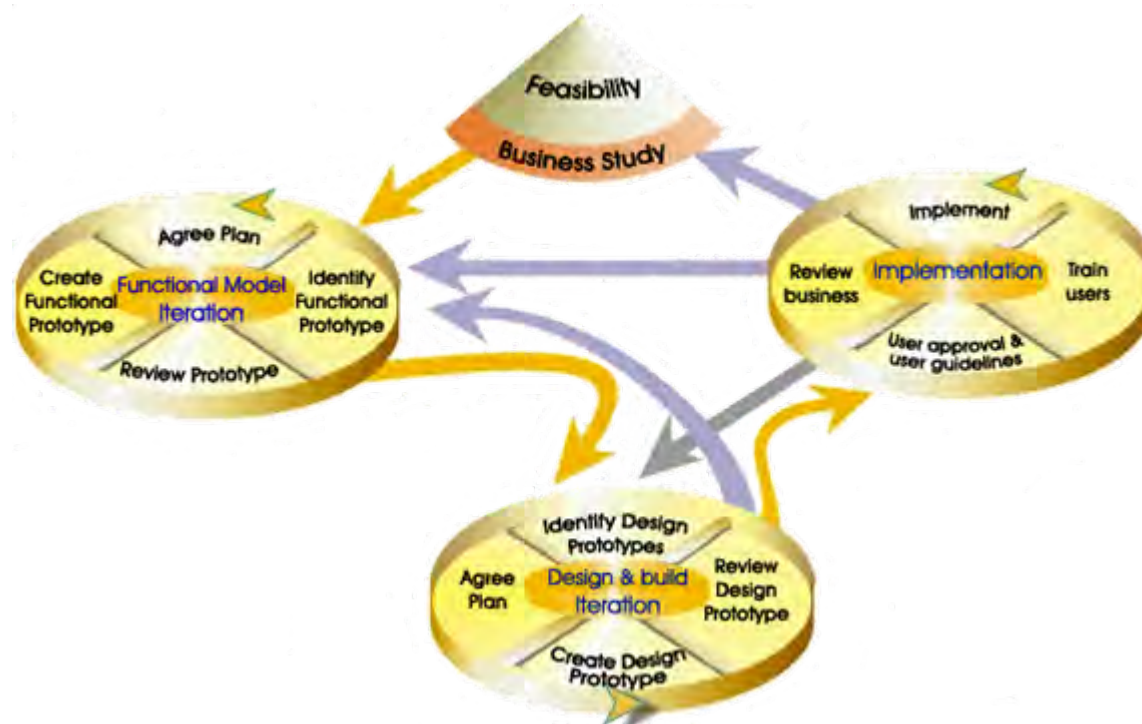
Stapleton, J. (1997). *DSDM: A framework for business centered development*. Harlow, England: Addison-Wesley.

Feature Driven Development

- Created by Jeff De Luca at Nebulon in 1997
- Has 8 practices, 14 roles, and 16 work products
- Uses object-oriented design and code inspections

Iteration

| Develop an Overall Model | → | Build a Features List | → | Plan by Feature | → | Design by Feature | → | Build by Feature |

Palmer, S. R., & Felsing, J. M. (2002). *A practical guide to feature driven development*. Upper Saddle River, NJ: Prentice-Hall.

Extreme Programming

- Created by Kent Beck at Chrysler in 1998
- Has 28 practices, 7 roles, and 7 work products
- <u>Popularized pair programming and test-driven dev.</u>
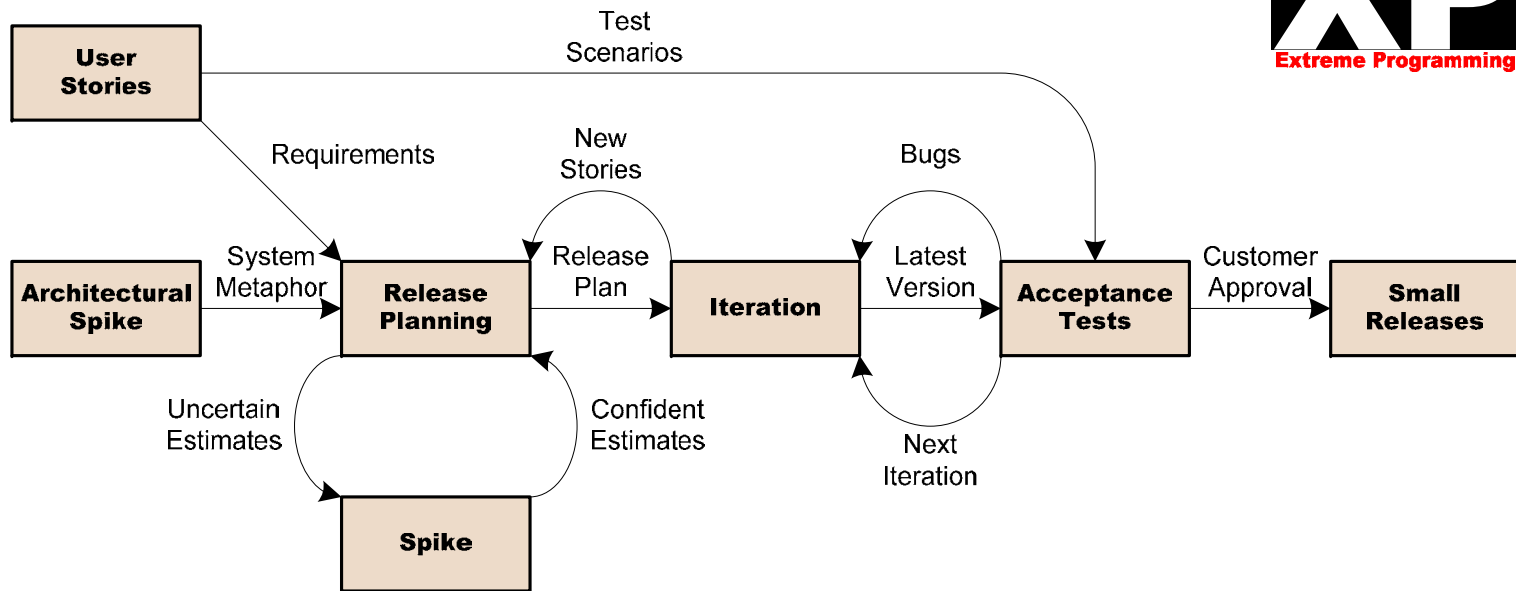
Beck, K. (2000). *Extreme programming explained*: *Embrace change*. Reading, MA: Addison-Wesley.

Kanban

- Adapted to IT by Dave Anderson in 2006
- Activities, buffers, queues, WIP limits, tasks, etc.
- <u>Lean, JIT pull/demand system leading to high quality</u>

Anderson, D. J. (2010). *Kanban*: *Successful evolutionary change for your technology business*. Sequim, WA: Blue Hole Press.

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Intro to Agile Methods

Types of Agile Methods

☞ **PRACTICES of Agile Methods**

Studies of Traditional Methods

Cost & Benefits of Agile Methods

Business Value of Agile Methods

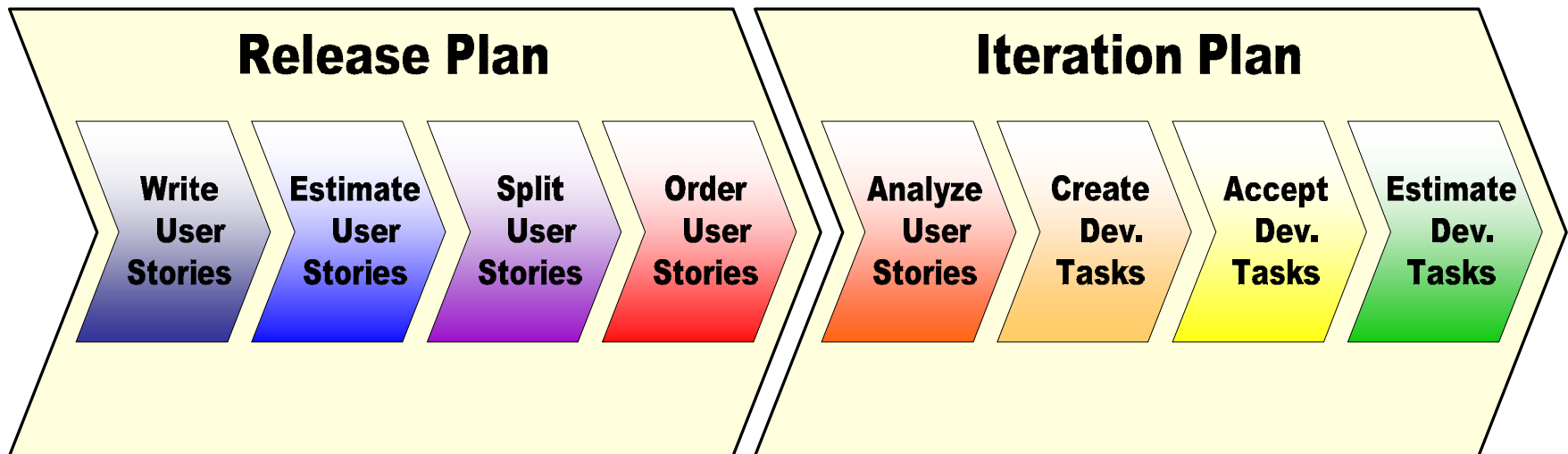**Comparison** of Agile Methods

Summary of Agile Methods

Onsite Customers

- Term coined by Kent Beck in 1999
- Customer who sits with developers full-time
- <u>Fast and efficient way to capture customer needs</u>

Tabaka, J. (2006). *Collaboration explained*: *Facilitation skills for software project leaders*. Upper Saddle River, NJ: Addison Wesley.
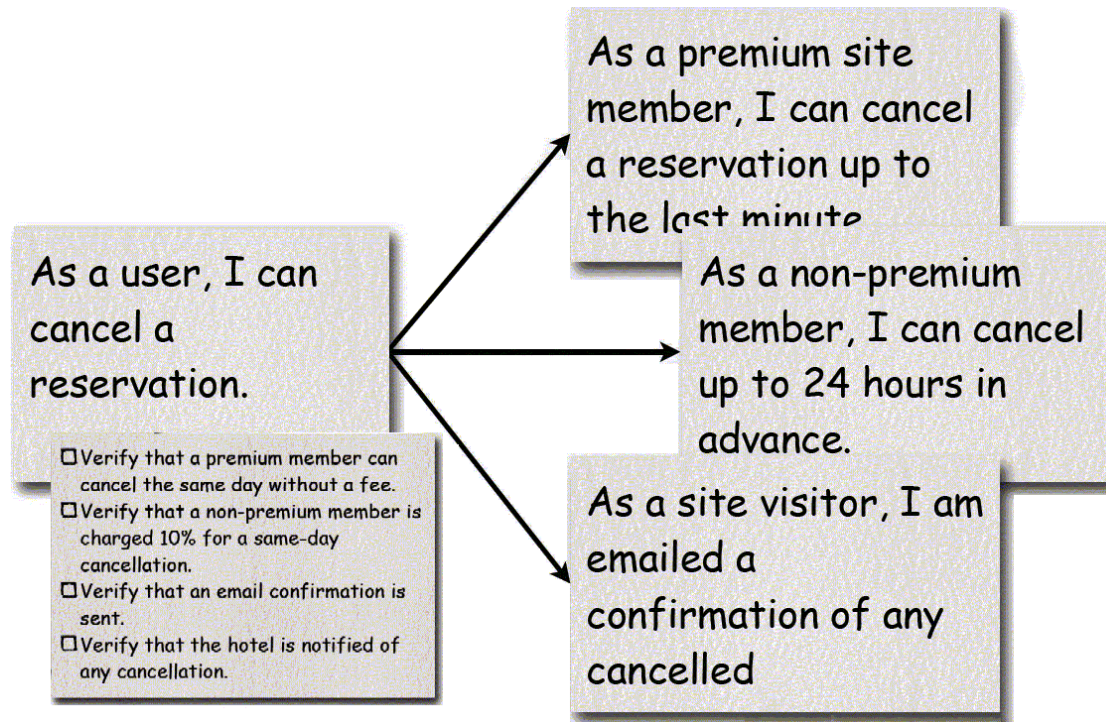
Release Planning

- Created by Kent Beck at Chrysler in 1998
- Project plan with a 30-60-90-day timing horizon
- Disciplined and adaptable project management F/W

Release Plan

Write User Stories	Estimate User Stories	Split User Stories	Order User Stories

Iteration Plan

Analyze User Stories	Create Dev. Tasks	Accept Dev. Tasks	Estimate Dev. Tasks

Beck, K., & Fowler, M. (2004). *Planning extreme programming*. Upper Saddle River, NJ: Addison-Wesley.

User Stories

- Term coined by Kent Beck in 1999
- Functions or features of value to customers
- <u>Highly-adaptable requirements engineering process</u>

As a user, I can cancel a reservation.

☐ Verify that a premium member can cancel the same day without a fee.
☐ Verify that a non-premium member is charged 10% for a same-day cancellation.
☐ Verify that an email confirmation is sent.
☐ Verify that the hotel is notified of any cancellation.

As a premium site member, I can cancel a reservation up to the last minute.

As a non-premium member, I can cancel up to 24 hours in advance.

As a site visitor, I am emailed a confirmation of any cancelled

Cohn, M. (2004). *User stories applied*: *For agile software development*. Boston, MA: Addison-Wesley.

Test-Driven Development

- Term coined by Kent Beck in 2003
- Consists of writing all tests before design
- Ensures all components are verified and validated
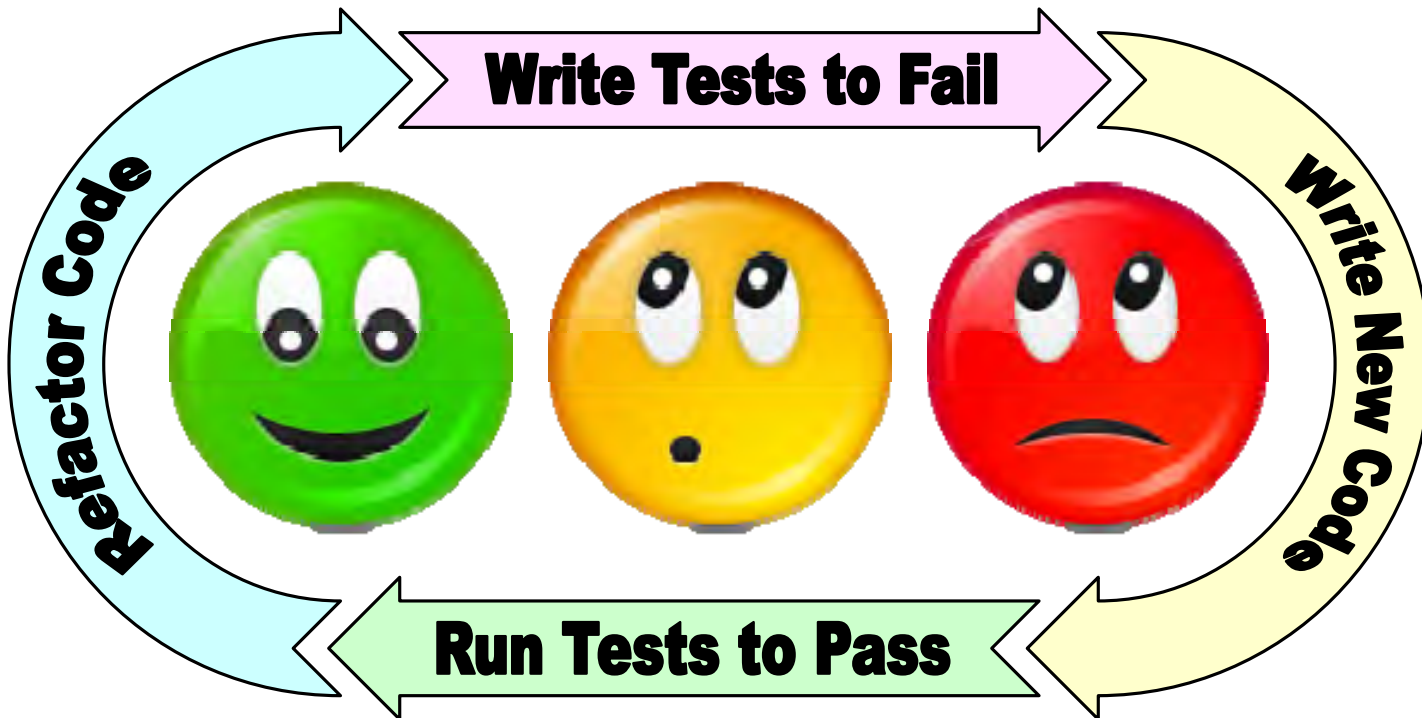
Beck, K. (2003). *Test-driven development*: *By example*. Boston, MA: Addison-Wesley.

Pair Development

- ☐ Term coined by Jim Coplien in 1995
- ☐ Consists of two side-by-side developers
- ☐ <u>Highly-effective group problem-solving technique</u>

Williams, L., & Kessler, R. (2002). *Pair programming illuminated*. Boston, MA: Pearson Education.
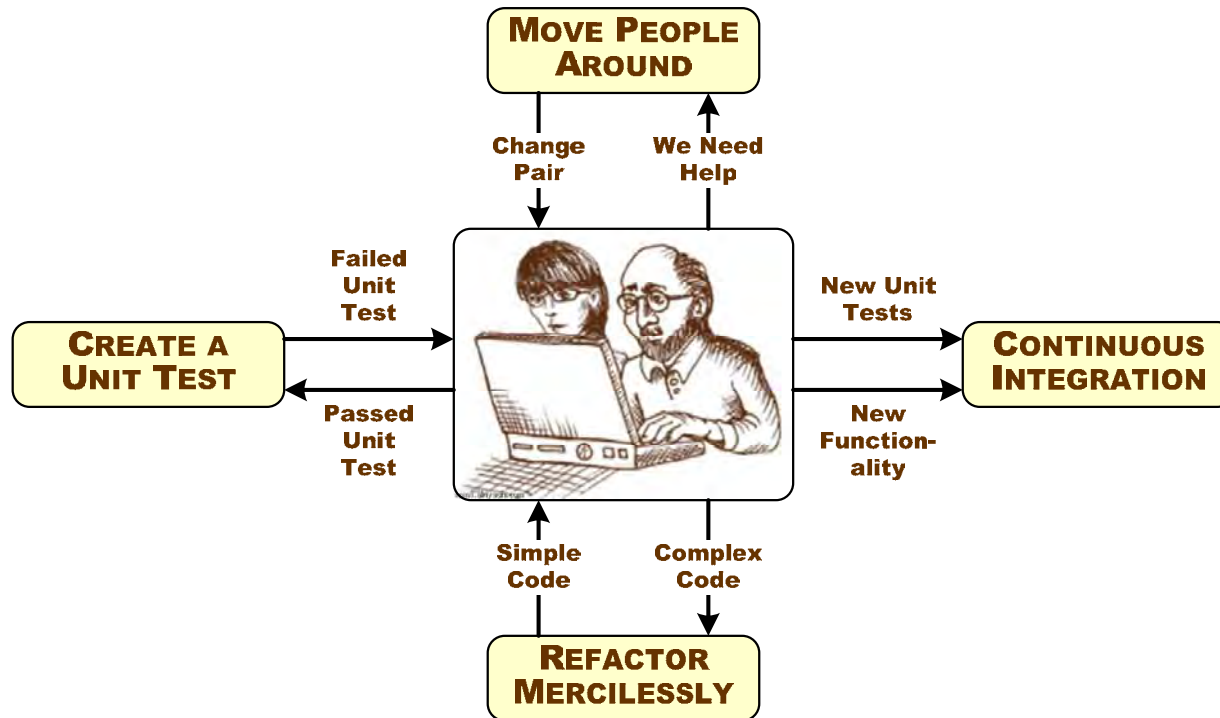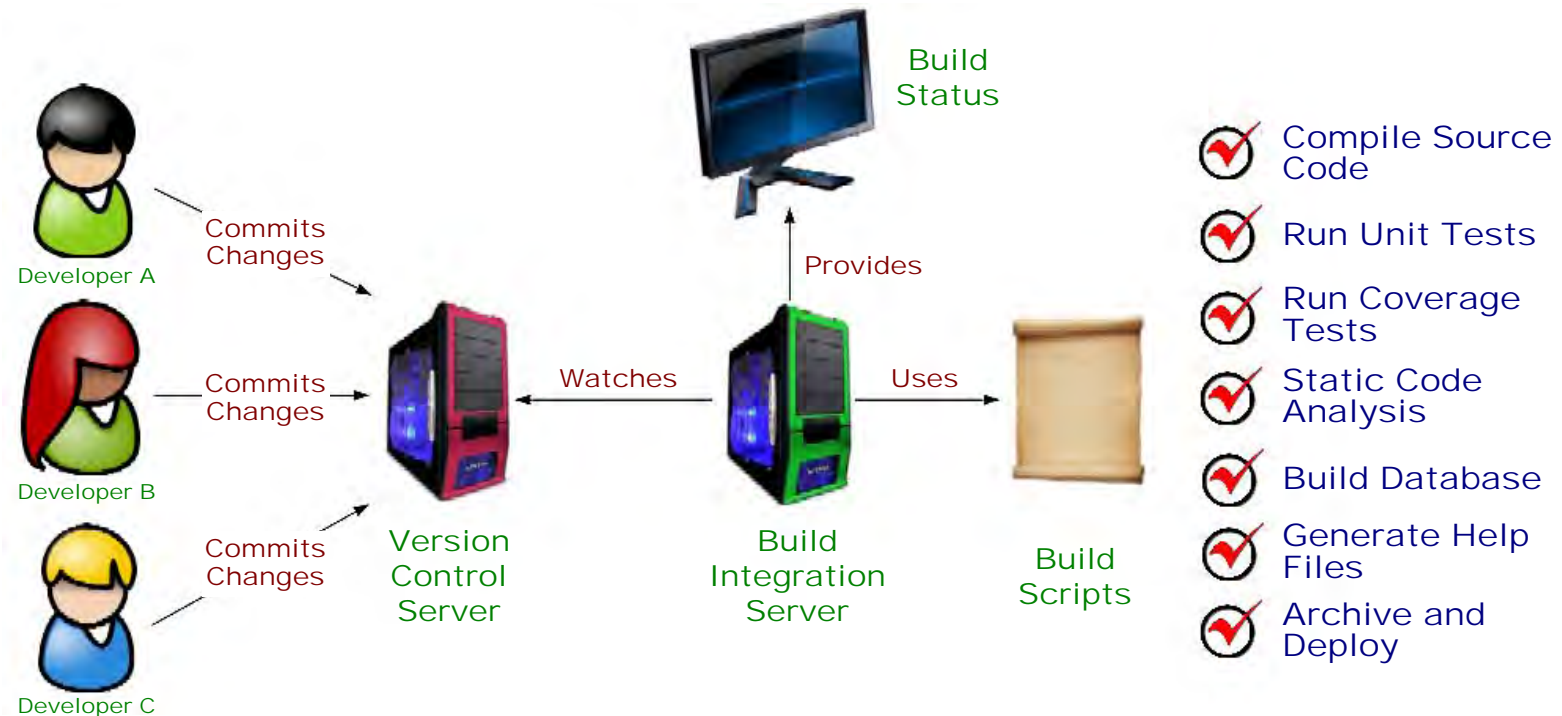
Refactoring

- □ Term coined by William Opdyke in 1990
- □ Process of frequently redesigning the system
- □ Improves readability, maintainability, and quality

Fowler, M. (1999). *Refactoring*: *Improving the design of existing code*. Boston, MA. Addison-Wesley.
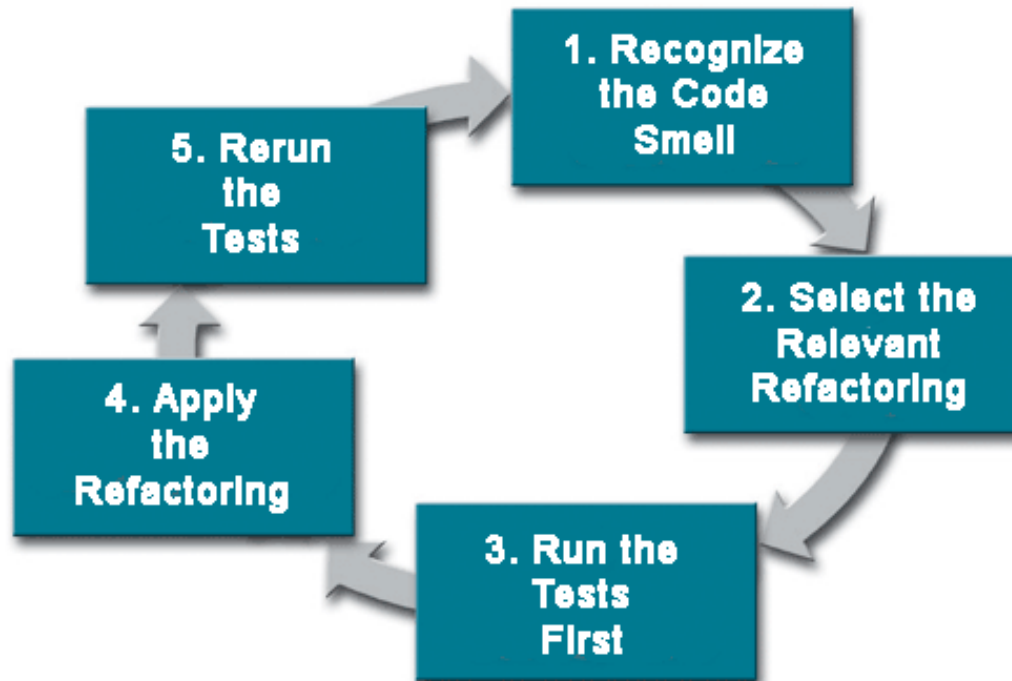
Continuous Integration

- ☐ Term coined by Martin Fowler in 1998
- ☐ Process of automated build/regression testing
- ☐ <u>Evaluates impact of changes against entire system</u>

Build Status

Developer A — Commits Changes →

Developer B — Commits Changes →

Developer C — Commits Changes →

Version Control Server ← Watches — **Build Integration Server** — Uses → **Build Scripts**

Provides ↑

- ✓ **Compile Source Code**
- ✓ **Run Unit Tests**
- ✓ **Run Coverage Tests**
- ✓ **Static Code Analysis**
- ✓ **Build Database**
- ✓ **Generate Help Files**
- ✓ **Archive and Deploy**

Duvall, P., Matyas, S., & Glover, A. (2006). *Continuous integration*: *Improving software quality and reducing risk*. Boston, MA: Addison-Wesley.

Humble, J., & Farley, D. (2011). *Continuous delivery*: *Reliable software releases through build, test, and deployment automation*. Boston, MA: Pearson.

Agenda

Intro to Agile Methods

Types of Agile Methods

Practices of Agile Methods

☞ STUDIES of Agile Methods

Cost & Benefits of Agile Methods

Business Value of Agile Methods

Comparison of Agile Methods

Summary of Agile Methods

Surveys of Agile Methods

- Many surveys of agile methods since 2003
- AmbySoft and VersionOne collect annual data
- <u>Agile benefits are above 50% in most categories</u>

Year	Organization	Author	Size	Productivity	Quality	Cost
2003	Shine	Johnson	131	93%	88%	49%
2006	Agile Journal	Barnett	400	45%	43%	23%
2007	Microsoft	Begel, et al.	492	14%	32%	16%
2007	UMUC	Rico, et al.	250	81%	80%	75%
2008	AmbySoft	Ambler	642	82%	72%	72%
2008	IT Agile	Wolf, et al.	207	78%	74%	72%
2008	Version One	Hanscom	3,061	74%	68%	38%
Average				**67%**	**65%**	**49%**

Rico, D. F. (2008). *What is the return-on-investment of agile methods*? Retrieved February 3, 2009, from http://davidfrico.com/rico08a.pdf
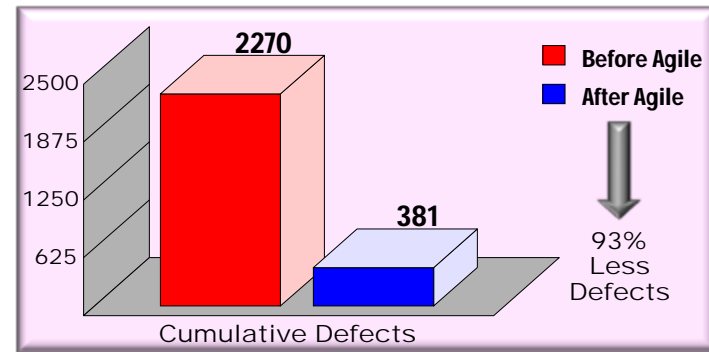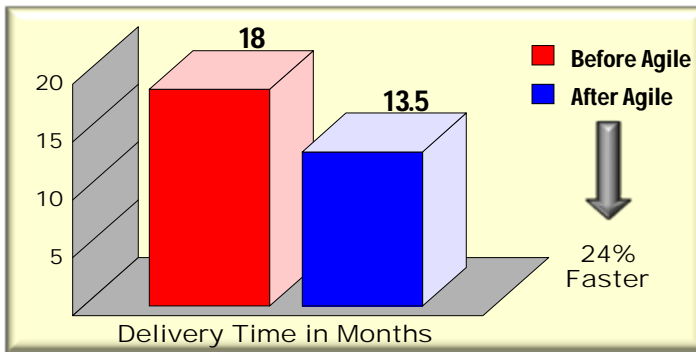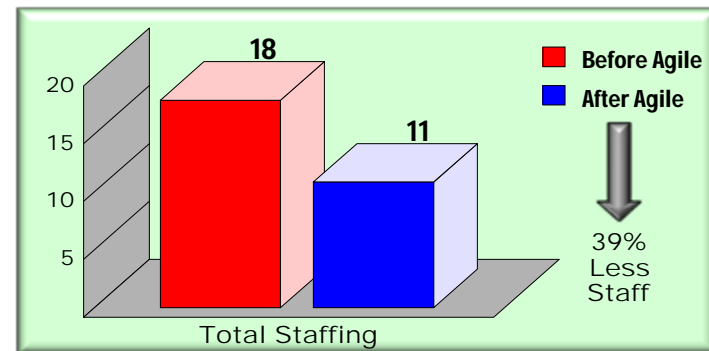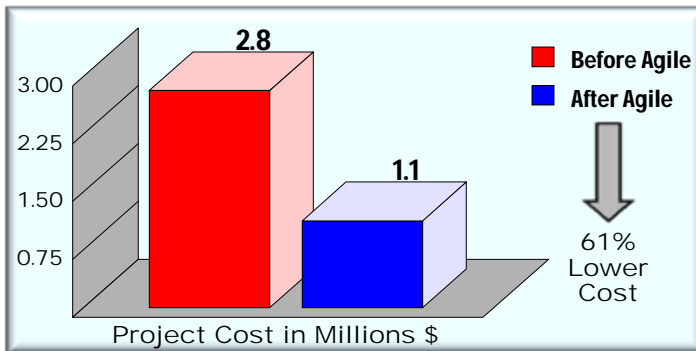
Studies of Agile Methods

- Agile (138 pt.) and traditional methods (99 pt.)
- Agile methods fare better in all benefits categories
- Agile methods 359% better than traditional methods

Category	Agile	Traditional	Difference
Cost Reduction	29%	20%	*9%*
Schedule Reduction	70%	37%	*33%*
Productivity Improvement	117%	62%	*55%*
Quality Improvement	74%	50%	*24%*
Customer Satisfaction Imp.	70%	14%	*56%*
Return on Investment	2,811%	470%	*2,341%*

Rico, D. F. (2008). What is the ROI of agile vs. traditional methods? *TickIT International*, *10*(4), 9-18.

QSM Study (Putnam/SLIM)

- Analysis of 23 agile vs. 7,500 traditional projects
- Agile projects are 54% better than traditional ones
- <u>Agile has lower costs (61%) and fewer defects (93%)</u>

Mah, M. (2008). Measuring agile in the enterprise: *Proceedings of the Agile 2008 Conference, Toronto, Canada.*

BTM Study

- Study of 15 agile vs. non-agile Fortune 500 firms
- Based on models to measure organizational agility
- <u>Agile firms out perform non-agile firms by up to 36%</u>
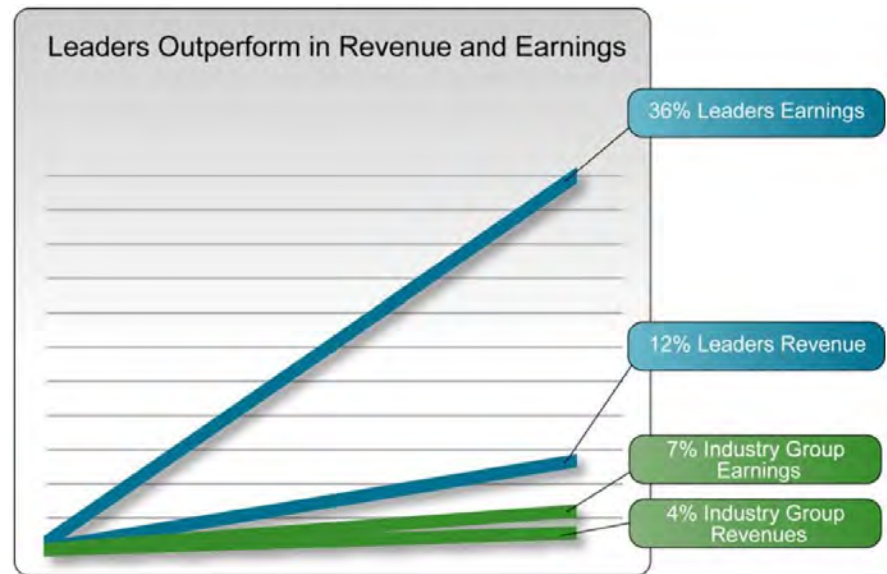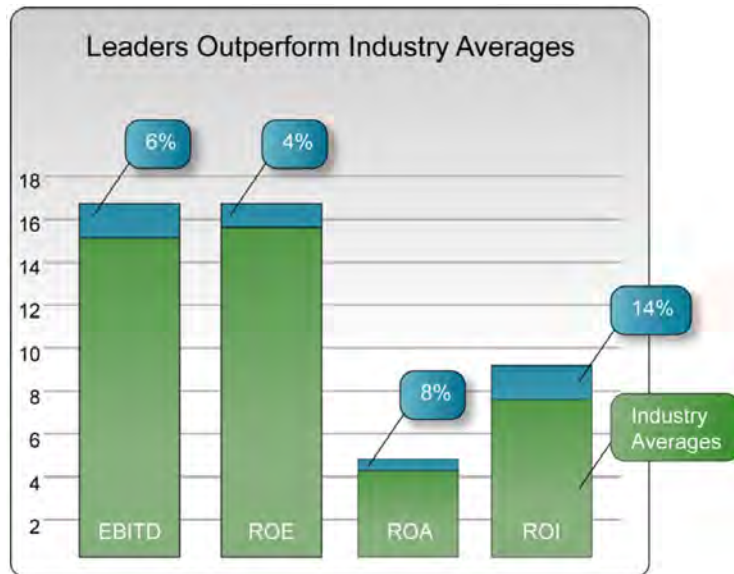
Hoque, F., et al. (2007). *Business technology convergence. The role of business technology convergence in innovation and adaptability and its effect on financial performance.* Stamford, CT: BTM Institute.

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Intro to Agile Methods

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☞ **COST & BENEFITS of Agile Methods**

Business Value of Agile Methods

Comparison of Agile Methods

Summary of Agile Methods

Costs of Agile Methods

- **Costs** based on **productivity** and **quality** models
- Development costs based on $LOC \div productivity$ rate
- Maintenance costs based on $defects \times KLOC \times MH$

No.	Method	Agile Lifecycle Cost Models	Costs
1.	XP	$(10{,}000 \div 16.1575 + 0.7466 \times 10 \times 100) \times 100$	$136,551
2.	TDD	$(10{,}000 \div 29.2800 + 2.1550 \times 10 \times 100) \times 100$	$249,653
3.	PP	$(10{,}000 \div 33.4044 + 2.3550 \times 10 \times 100) \times 100$	$265,436
4.	Scrum	$(10{,}000 \div 05.4436 + 3.9450 \times 10 \times 100) \times 100$	$578,202
5.	Agile	$(10{,}000 \div 21.2374 + 1.7972 \times 10 \times 100) \times 100$	$226,807

Rico, D. F. (2008). What is the ROI of agile vs. traditional methods? *TickIT International*, *10*(4), 9-18.

Benefits of Agile Methods

- **Benefits** based on total traditional less agile **costs**
- Traditional costs based $LOC \times dev. + maint.$ effort
- Traditional costs credited testing effort applied

No.	Method	Agile Lifecycle Benefit Models	Benefits
1.	XP	$(10,000 \times 10.51 - 6,666.67 \times 9) \times 100 -$ **$136,551**	**$4,373,446**
2.	TDD	$(10,000 \times 10.51 - 6,666.67 \times 9) \times 100 -$ **$249,653**	**$4,260,344**
3.	PP	$(10,000 \times 10.51 - 6,666.67 \times 9) \times 100 -$ **$265,436**	**$4,244,561**
4.	Scrum	$(10,000 \times 10.51 - 6,666.67 \times 9) \times 100 -$ **$578,202**	**$3,931,795**
5.	Agile	$(10,000 \times 10.51 - 6,666.67 \times 9) \times 100 -$ **$226,807**	**$4,283,190**

Rico, D. F. (2008). What is the ROI of agile vs. traditional methods? *TickIT International*, *10*(4), 9-18.

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Cost & Benefits of Agile Methods

☞ **BUSINESS VALUE of Agile Methods**

Comparison of Agile Methods

Summary of Agile Methods

Measures of Business Value

- A major principle of Agile Methods is creating value
- ROI is the measure of value within Agile Methods
- <u>There are seven closely related ROI measures</u>

Metric	Definition	Formula
Costs **Sum of Costs**	Total amount of money spent	$\sum_{i=1}^{n} Cost_i$
Benefits **Sum of Benefits**	Total amount of money gained	$\sum_{i=1}^{n} Benefit_i$
B/CR **Benefit to Cost Ratio**	Ratio of benefits to costs	$\dfrac{Benefits}{Costs}$
ROI **Return on Investment**	Ratio of adjusted benefits to costs	$\dfrac{Benefits - Costs}{Costs} \times 100\%$
NPV **Net Present Value**	Discounted cash flows	$\sum_{i=1}^{Years} \dfrac{Benefits_i}{(1 + Discount\ Rate)^{Years}} - Costs_0$
BEP **Breakeven Point**	Point when benefits exceed costs	$\dfrac{New\ Costs}{Old\ Costs / New\ Costs - 1}$
ROA **Real Options Analysis**	Value gained from strategic delay	$N(d_1) \times Benefits - N(d_2) \times Costs \times e^{-Rate \times Years}$

$d1 = [ln(Benefits \div Costs) + (Rate + 0.5 \times Risk^2) \times Years] \div Risk \times \sqrt{Years}, \ d2 = d1 - Risk \times \sqrt{Years}$

Rico, D. F., Sayani, H. H., & Sone, S. (2009). *The business value of agile software methods*: *Maximizing ROI with just-in-time processes and documentation*. Ft. Lauderdale, FL: J. Ross Publishing.

Extreme Programming

- **Costs** based on *avg*. **productivity** and **quality**
- **Productivity** ranged from **3.5** to **43** LOC an hour
- **Costs** were **$136,551**, **benefits** were **$4,373,446**

Metric	Formula	Value
Costs	$(10{,}000 \div \mathbf{16.1575} + \mathbf{0.7466} \times 10 \times 30) \times 100$	**$136,551**
Benefits	$(10{,}000 \times 10.51 - 6{,}666.7 \times 9) \times 100 - $**$136,551**	**$4,373,446**
B/CR	**$4,373,446** $\div$ **$136,551**	32:1
ROI	(**$4,373,446** $-$ **$136,551**) $\div$ **$136,551** $\times 100\%$	3,103%
NPV	$(\sum_{i=1}^{5}$ **$4,373,446** $\div 5) \div 1.05^{5}) - $**$136,551**	$3,650,396
BEP	**$136,551** $\div$ ($4,509,997 $\div$ **$136,551** $- 1$)	$4,263
ROA	$NORMSDIST\,(8.07) \times$ **$4,373,446** $-$ $NORMSDIST\,(7.59) \times$ **$136,551** $\times EXP\,(-5\% \times 5)$	$4,267,100

Rico, D. F., Sayani, H. H., & Sone, S. (2009). *The business value of agile software methods*: *Maximizing ROI with just-in-time processes and documentation*. Ft. Lauderdale, FL: J. Ross Publishing.

Test Driven Development

- **Costs** based on *avg*. **productivity** and **quality**
- **Productivity** ranged from **12** to **46** LOC an hour
- **Costs** were **$249,653**, **benefits** were **$4,260,344**

Metric	Formula	Value
Costs	$(10,000 \div \mathbf{29.2800} + \mathbf{2.1550} \times 10 \times 100) \times 100$	**$249,653**
Benefits	$(10,000 \times 10.51 - 6,666.67 \times 9) \times 100 - \mathbf{\$249,653}$	**$4,260,344**
B/CR	**$4,260,344** ÷ **$249,653**	17:1
ROI	$(\mathbf{\$4,260,344} - \mathbf{\$249,653}) \div \mathbf{\$249,653} \times 100\%$	1,607%
NPV	$(\sum_{i=1}^{5} \mathbf{\$4,260,344} \div 5) \div 1.05^{5}) - \mathbf{\$249,653}$	$3,439,359
BEP	$\mathbf{\$249,653} \div (\$4,509,997 \div \mathbf{\$249,653} - 1)$	$14,629
ROA	$\text{NORMSDIST}(2.79) \times \mathbf{\$4,260,344} - \text{NORMSDIST}(1.27) \times \mathbf{\$249,653} \times \text{EXP}(-5\% \times 5)$	$4,074,506

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Pair Programming

- **Costs** based on *avg*. **productivity** and **quality**
- **Productivity** ranged from **15** to **86** LOC an hour
- **Costs** were **$265,436**, **benefits** were **$4,244,561**

Metric	Formula	Value
Costs	$(10{,}000 \div \mathbf{33.4044} + \mathbf{2.3550} \times 10 \times 100) \times 100$	**$265,436**
Benefits	$(10{,}000 \times 10.51 - 6{,}666.67 \times 9) \times 100 -$ **$265,436**	**$4,244,561**
B/CR	**$4,244,561** $\div$ **$265,436**	16:1
ROI	(**$4,244,561** $-$ **$265,436**) $\div$ **$265,436** $\times 100\%$	1,499%
NPV	$(\sum_{i=1}^{5}$ (**$4,244,561** $\div 5) \div 1.05^{5}) -$ **$265,436**	$3,409,909
BEP	**$265,436** $\div$ ($4,509,997 $\div$ **$265,436** $- 1)$	$16,599
ROA	$\text{NORMSDIST}(2.69) \times$ **$4,244,561** $-$ $\text{NORMSDIST}(1.10) \times$ **$265,436** $\times \text{EXP}(-5\% \times 5)$	$4,050,919

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Scrum

- **Costs** based on avg. **productivity** and **quality**
- **Productivity** ranged from **4.7** to **5.9** LOC an hour
- **Costs** were **$578,202**, **benefits** were **$3,931,795**

Metric	Formula	Value
Costs	$(10{,}000 \div \mathbf{5.4436} + \mathbf{3.9450} \times 10 \times 100) \times 100$	**$578,202**
Benefits	$(10{,}000 \times 10.51 - 6{,}666.67 \times 9) \times 100 - \mathbf{\$578{,}202}$	**$3,931,795**
B/CR	$\mathbf{\$3{,}931{,}795} \div \mathbf{\$578{,}202}$	7:1
ROI	$(\mathbf{\$3{,}931{,}795} - \mathbf{\$578{,}202}) \div \mathbf{\$578{,}202} \times 100\%$	580%
NPV	$(\sum_{i=1}^{5} (\mathbf{\$3{,}931{,}795} \div 5) \div 1.05^5) - \mathbf{\$578{,}202}$	$2,826,321
BEP	$\mathbf{\$578{,}202} \div (\$4{,}509{,}997 \div \mathbf{\$578{,}202} - 1)$	$85,029
ROA	$\text{NORMSDIST}(2.08) \times \mathbf{\$3{,}931{,}795} - \text{NORMSDIST}(-0.15) \times \mathbf{\$578{,}202} \times \text{EXP}(-5\% \times 5)$	$3,660,805

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Agile Methods

- **Costs** based on $avg.$ **productivity** and **quality**
- **Productivity** ranged from **3.5** to **86** LOC an hour
- **Costs** were **$226,807**, **benefits** were **$4,283,190**

Metric	Formula	Value
Costs	$(10{,}000 \div 21.2374 + 1.7972 \times 10 \times 100) \times 100$	**$226,807**
Benefits	$(10{,}000 \times 10.51 - 6{,}666.67 \times 9) \times 100 - \$226{,}807$	**$4,283,190**
B/CR	$\$4{,}283{,}190 \div \$226{,}807$	19:1
ROI	$(\$4{,}283{,}190 - \$226{,}807) \div \$226{,}807 \times 100\%$	1,788%
NPV	$(\sum_{i=1}^{5} \$4{,}283{,}190 \div 5) \div 1.05^5) - \$226{,}807$	$3,481,988
BEP	$\$226{,}807 \div (\$4{,}509{,}997 \div \$226{,}807 - 1)$	$12,010
ROA	NORMSDIST(2.99) $\times$ **$4,283,190** $-$ NORMSDIST(1.59) $\times$ **$226,807** $\times$ EXP($-5\% \times 5$)	$4,110,305

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Agenda

Intro to Agile Methods

Types of Agile Methods

Practices of Agile Methods

Studies of Agile Methods

Cost & Benefits of Agile Methods

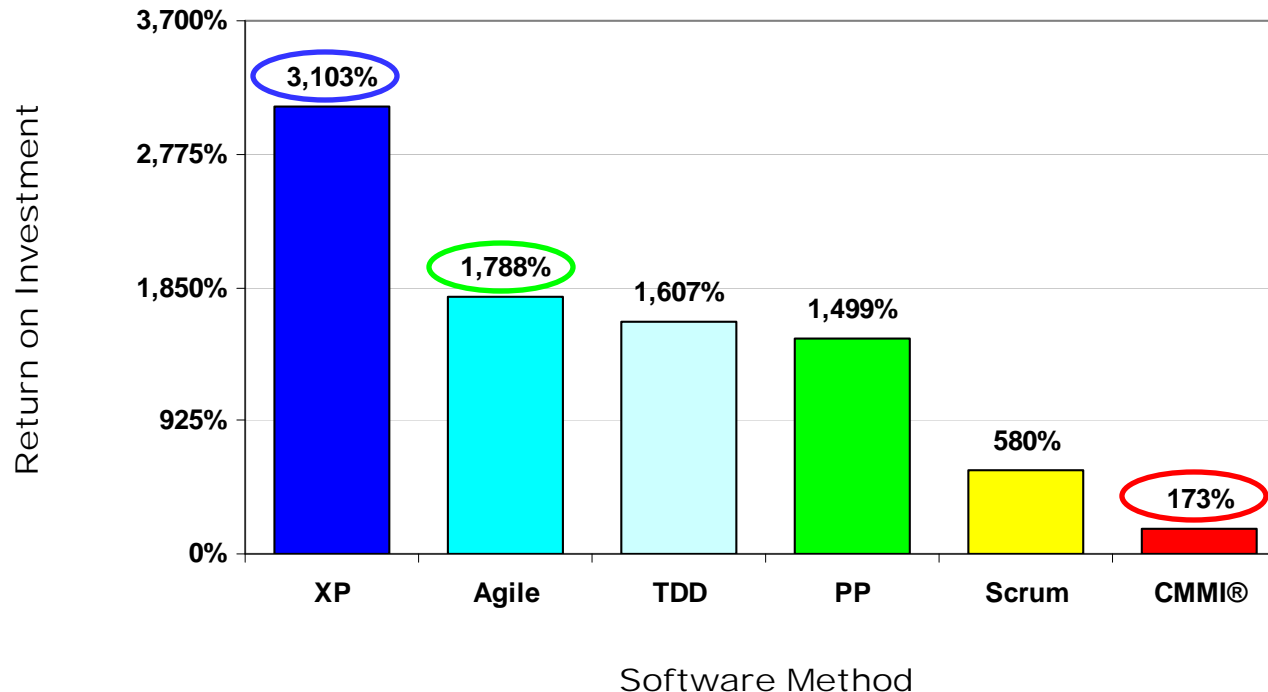**Business Value** of Agile Methods

☞ **COMPARISON of Agile Methods**

Summary of Agile Methods

ROI of Agile Methods

- XP ROI 18X more than traditional methods
- Scrum ROI 3.4X more than traditional methods
- <u>Agile methods ROI 10X more than trad. methods</u>

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Agenda

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☞ **SUMMARY of Agile Methods**

Myths of Agile Methods

- Common myths still abound, although agile methods have been around for ~20 years:
  - *Agile is only for* software engineering
  - *Agile doesn't scale to* large systems
  - *Agile doesn't use* project management
  - *Agile doesn't have any* requirements
  - *Agile requires a traditional* system architecture
  - *Agile doesn't have any* documentation
  - *Agile isn't* disciplined *or* measurable
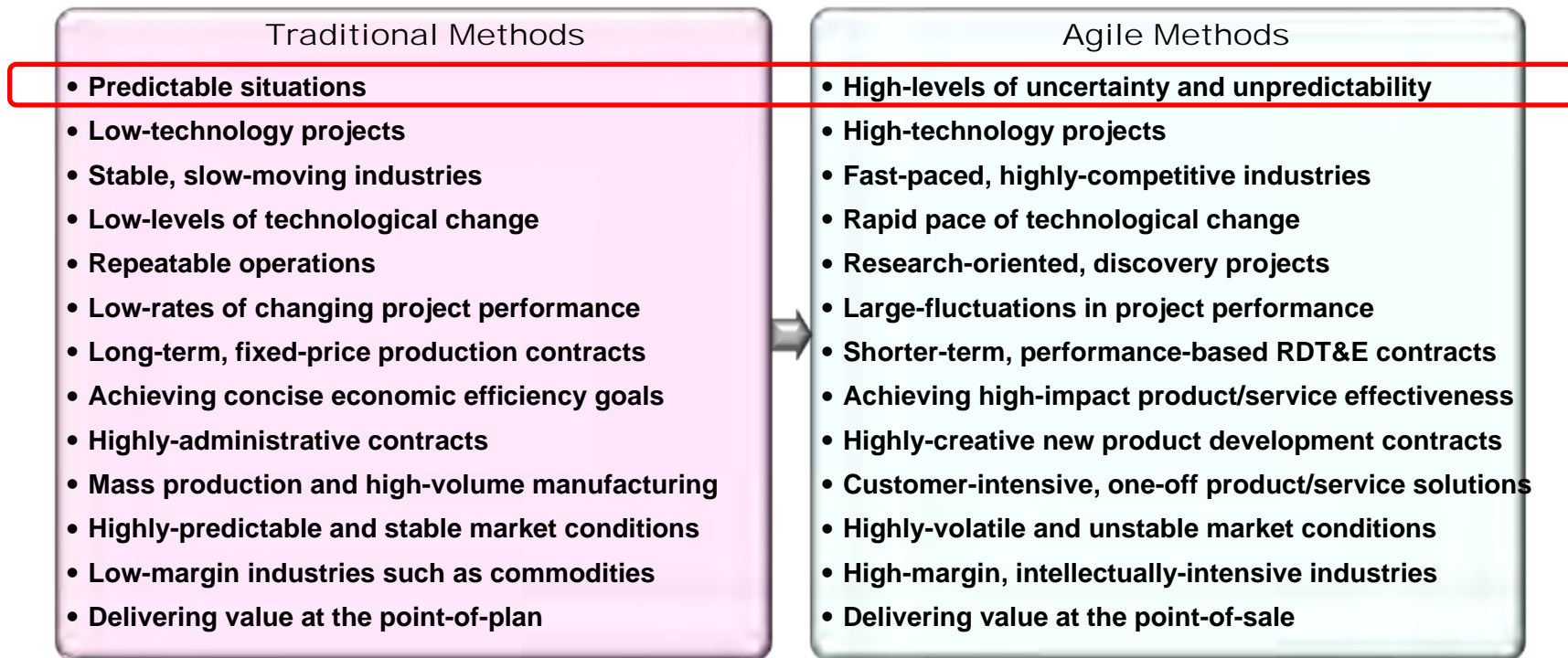 - *Agile has low* quality, maintainability, *and* security

Agile Documentation

- ☐ Myth that voluminous documentation is needed
- ☐ Myth that agile methods do not use documentation
- ☐ <u>Right-sized, just-in-time, and just enough documents</u>

Document Type	Agile Documentation
Contracts	Performance-based, time-and-materials, level-of-effort
Project Plans	Release plans, iteration plans, story boards, agile repositories
Requirements	User stories, wire frames, use cases, paper prototypes
Architecture	Metaphors, spikes, system modeling language, DoDAF
Design	Wire frames, design patterns, unified modeling language
Coding	Code patterns, program design language, coding comments
Tests	Unit, component, integration, system, and acceptance tests
User guides	XML documents, online help, Wikis, FAQs, video and audio clips
Quality Assurance	Performance, reliability, code structure analysis, and test reports

Rueping, A. (2003). *Agile documentation*: *A pattern guide to producing lightweight documents for software projects*. West Sussex, England: John Wiley & Sons.

When to Use Agile Methods

- ☐ On exploratory or research/development projects
- ☐ When fast customer responsiveness is paramount
- ☐ <u>In organizations that are highly-innovative & creative</u>

Traditional Methods	Agile Methods
• Predictable situations	• High-levels of uncertainty and unpredictability
• Low-technology projects	• High-technology projects
• Stable, slow-moving industries	• Fast-paced, highly-competitive industries
• Low-levels of technological change	• Rapid pace of technological change
• Repeatable operations	• Research-oriented, discovery projects
• Low-rates of changing project performance	• Large-fluctuations in project performance
• Long-term, fixed-price production contracts	• Shorter-term, performance-based RDT&E contracts
• Achieving concise economic efficiency goals	• Achieving high-impact product/service effectiveness
• Highly-administrative contracts	• Highly-creative new product development contracts
• Mass production and high-volume manufacturing	• Customer-intensive, one-off product/service solutions
• Highly-predictable and stable market conditions	• Highly-volatile and unstable market conditions
• Low-margin industries such as commodities	• High-margin, intellectually-intensive industries
• Delivering value at the point-of-plan	• Delivering value at the point-of-sale

Pine, B. J. (1993). *Mass customization*: *The new frontier in business competition*. Boston, MA: Harvard Business School Press.
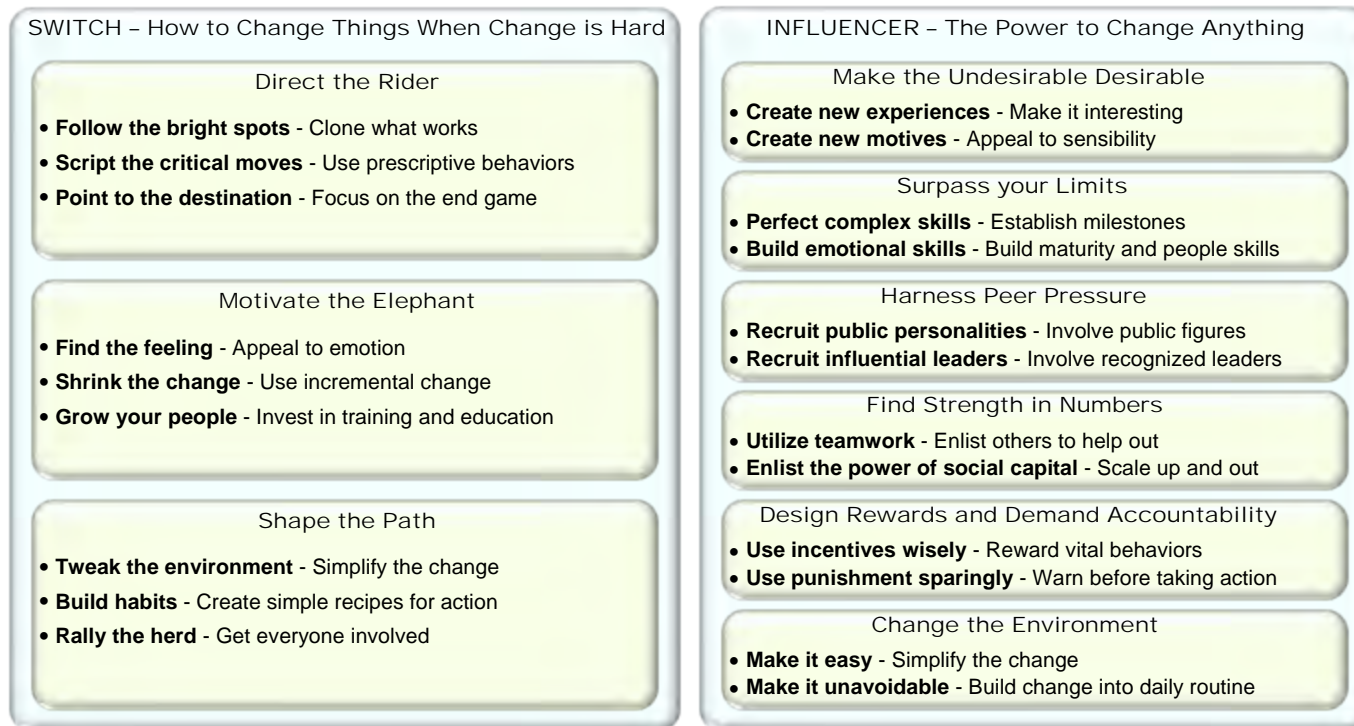
Why is Change Difficult?

- Humans can't cope with large technological change
- Changes may be resisted for a long time (years)
- <u>Big projects plunge organizations into chaos</u>
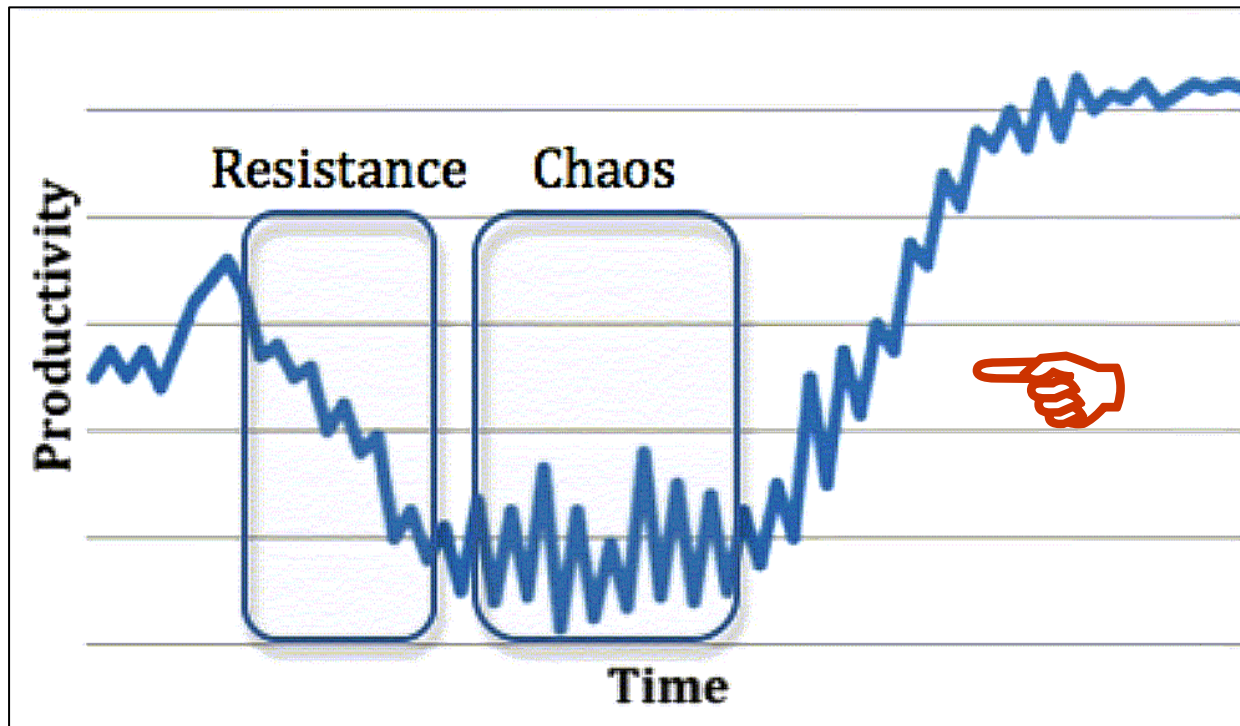
Smith, G., & Sidky, A. (2009). *Becoming agile*: *In an imperfect world*. Greenwich, CT: Manning Publications.

How to Cross the Chasm

- ☐ Change, no matter how small or large, is difficult
- ☐ Cross chasm sooner with smaller focused changes
- ☐ <u>Shrinking, simplifying, and motivation are key factors</u>

SWITCH – How to Change Things When Change is Hard

Direct the Rider
- **Follow the bright spots** - Clone what works
- **Script the critical moves** - Use prescriptive behaviors
- **Point to the destination** - Focus on the end game

Motivate the Elephant
- **Find the feeling** - Appeal to emotion
- **Shrink the change** - Use incremental change
- **Grow your people** - Invest in training and education

Shape the Path
- **Tweak the environment** - Simplify the change
- **Build habits** - Create simple recipes for action
- **Rally the herd** - Get everyone involved

INFLUENCER – The Power to Change Anything

Make the Undesirable Desirable
- **Create new experiences** - Make it interesting
- **Create new motives** - Appeal to sensibility

Surpass your Limits
- **Perfect complex skills** - Establish milestones
- **Build emotional skills** - Build maturity and people skills

Harness Peer Pressure
- **Recruit public personalities** - Involve public figures
- **Recruit influential leaders** - Involve recognized leaders

Find Strength in Numbers
- **Utilize teamwork** - Enlist others to help out
- **Enlist the power of social capital** - Scale up and out

Design Rewards and Demand Accountability
- **Use incentives wisely** - Reward vital behaviors
- **Use punishment sparingly** - Warn before taking action

Change the Environment
- **Make it easy** - Simplify the change
- **Make it unavoidable** - Build change into daily routine

Heath, C., & Heath, D. (2010). *Switch*: *How to change things when change is hard*. New York, NY: Random House.
Patterson, K., et al. (2008). *Influencer*: *The power to change anything*: New York, NY: McGraw-Hill.

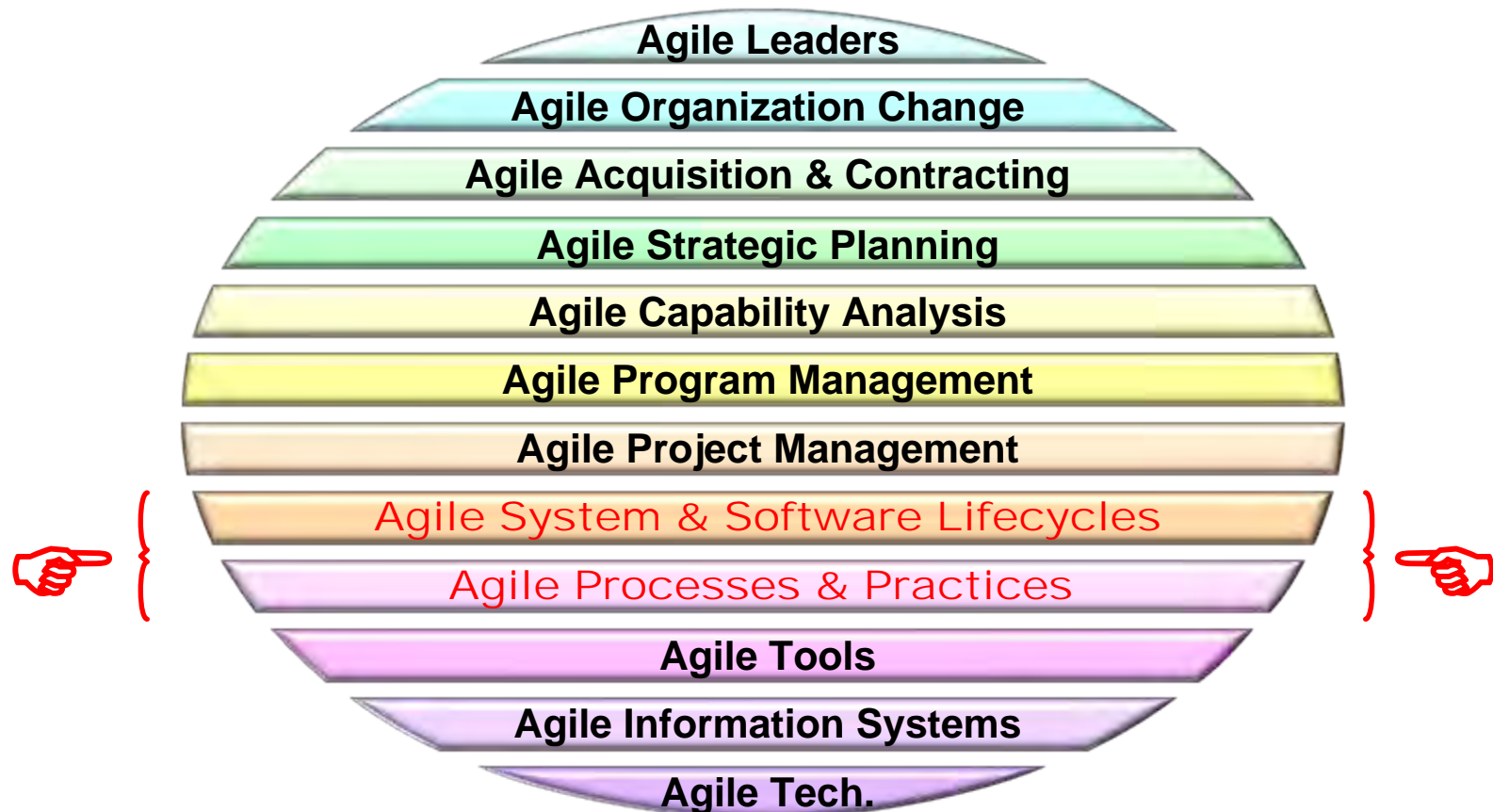# Benefits of Smaller Changes

- ☐ Enable us to cross-the-chasm sooner or earlier
- ☐ Reduce chaos associated with large-scale change
- ☐ <u>Reduce or divide the risk of change into small pieces</u>
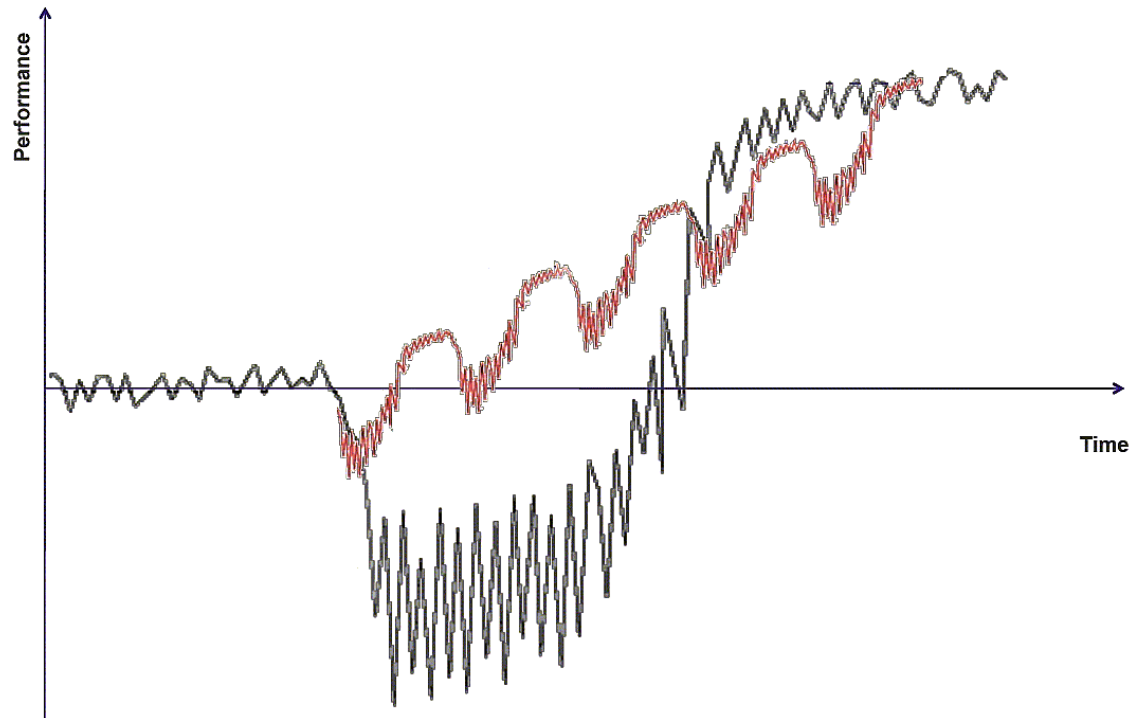
Smith, G., & Sidky, A. (2009). *Becoming agile*: *In an imperfect world*. Greenwich, CT: Manning Publications.

Agile Worldview

- "Agility" has many dimensions beyond IT
- It ranges from leadership to technological agility
- <u>This brief focused on costs & benefits of system dev.</u>

Agile Leaders

Agile Organization Change

Agile Acquisition & Contracting

Agile Strategic Planning

Agile Capability Analysis

Agile Program Management

Agile Project Management

Agile System & Software Lifecycles

Agile Processes & Practices

Agile Tools

Agile Information Systems

Agile Tech.

Business Value

- ☐ Technique for estimating ROI of Agile Methods
- ☐ Based on total life cycle costs (both devel./maint.)
- ☐ <u>Agile Methods have up to ~20 times lower total costs</u>

Agile methods and practices are ...

- ☑ **20 times less expensive**
- ☑ **19 times greater benefit/cost ratio**
- ☑ **23 times earlier break even point**
- ☑ **1,788% greater return on investment**
- ☑ **1,435% greater ROI based on net present value**
- ☑ **1,712% greater ROI based on real options analysis**

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New Book on Agile Methods

- Guide to Agile Methods for business leaders
- Communicates business value of Agile Methods
- Rosetta stone to Agile Methods for traditional folks

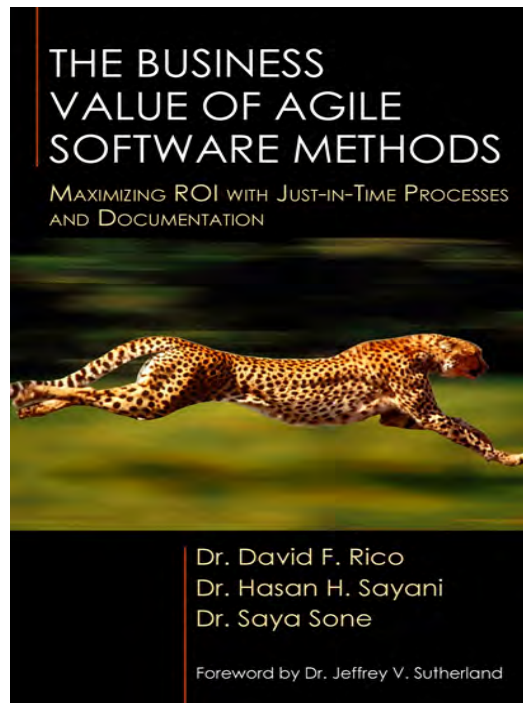## THE BUSINESS VALUE OF AGILE SOFTWARE METHODS

MAXIMIZING ROI WITH JUST-IN-TIME PROCESSES AND DOCUMENTATION

Dr. David F. Rico
Dr. Hasan H. Sayani
Dr. Saya Sone

Foreword by Dr. Jeffrey V. Sutherland

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http://davidfrico.com/agile-book.htm (*Description*)
http://www.amazon.com/dp/1604270314 (*Amazon*)