Lean & Agile Project Management

for Large Programs & Projects

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Agenda

- Overview of Agile Project Mgt.

Intro to Agile Project Mgt.

Types of Agile Project Mgt.

Phases of Agile Project Mgt.

Scaling Agile Project Mgt.

Metrics for Agile Project Mgt.

Cases of Agile Project Mgt.

Summary of Agile Project Mgt.

Author

- DoD contractor with 27+ years of IT experience
- B.S. Comp. Sci., M.S. Soft. Eng., & D.M. Info. Sys.
- Large gov't projects in U.S., Far/Mid-East, & Europe

→ *Published six books & numerous journal articles*
→ *Adjunct at George Washington, UMUC, & Argosy*
→ *<u>Agile Program Management & Lean Development</u>*
→ *Expertise in metrics, models, & cost engineering*
→ *Six Sigma, CMMI, ISO 9001, DoDAF & DoD 5000*

What is Agility?

- A-gil-i-ty (ə-'ji-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?

- Adaptable system development methodologies
- Human-centric method for creating business value
- Alternative to large document-based methodologies

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

How do Lean & Agile Intersect?

- Lean thinking provides the what (requirements)
- Agile thinking provides the how (implementation)
- Agile Methods are lean, light, adaptable, and flexible

Agile Pillars	Agile Principles	Lean Pillars	Lean Principles	Other Principles
Customer collaboration	Intensive customer collaboration and interaction	Respect for people	Customer defines value	Economic view
			Customer pulls value	Fast feedback
Individuals and interactions	Small empowered high-performance multi-disciplinary teams		Respect for people	Decentralize control
Working systems and software	Iterative development of working operational systems and software	Continuous improvement	Continuous flow	Reduce batch size
				Control cadence
			Continuous improvement	Manage queue size
				Exploit variability
Responding to change	Responding to change with flexible culture, process, and product		Map value stream (eliminate waste)	Manage work-in-process

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).

Essence of Agile Methods

- High degree of customer & developer interaction
- Highly-skilled teams producing frequent iterations
- Right-sized, just-enough, and just-in-time process

Highsmith, J. A. (2002). *Agile software development ecosystems.* Boston, MA: Addison-Wesley.

When to use Agile Methods

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

Thomke, S. (2003). *Experimentation matters*: *Unlocking the potential of new technologies for innovation*. Boston, MA: Harvard Business School Publishing.
Reinertsen, D. G. (2009). *The principles of product development flow*: *Second generation lean product development*. New York, NY: Celeritas.

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Agile World View

- "Agility" has many dimensions other than software
- Ranges from organizational to technological agility
- The focus of this brief is project management agility

Today's Environment

- Highly-unstable global and domestic markets
- Technology is evolving at an exponential speed
- Project plans cannot cope with this level of volatility

Market	Technology	Organization	Project	People	Result
• Fierce rivalry	• Economic driver	• Downsizing	• Vague requirements	• Inability to cope	• Poor performance
• Global competition	• Market driver	• Restructuring	• Volatile specs.	• High stress	• Cost overruns
• Restructuring	• Dependent	• Bankruptcy	• Shorter schedules	• Over-allocated	• Schedule overruns
• Market fluctuation	• Constant change	• Mergers & Acq.	• Smaller budgets	• Over-worked	• Poor quality
• Currency instability	• Exponential change	• Lost revenues	• More work	• Work-life imbalance	• 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 and 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	• High attrition
• 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
- With just the right balance of flexibility and discipline

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

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Agile Project Management

- APM (ā-pē-ĕm): Lightweight, flexible, adaptive, and collaborative; To be market or customer-responsive:
  - Rapidly *and* reliably *creating value by engaging* customers, *continuously learning, and* adapting
  - *Sound, yet* flexible process *to manage projects under* uncertainty, *urgency, and a need for* unique expertise
  - *Managing the flow of* human *thoughts, emotions, and* interactions *in a way that produces* business value
  - Values, principles, *and* practices *to help project teams in coming to grips with a challenging environment*

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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.

Values of APM

- Agile Manifesto (2001) focuses on collaboration
- DOI (2005) focuses on creating business value
- APM Values (2010) focus on all-around agility

Agile Manifesto

- ***Individuals and interactions***
- ***Working software***
- ***Customer collaboration***
- ***Responding to change***

Declaration of Interdependence

- **Increase return on investment**
- **Deliver reliable results**
- **Expect uncertainty**
- **Unleash creativity and innovation**
- **Boost performance**
- **Improve effectiveness and reliability**

APM Values

- **Delivering value over meeting constraints**
- **Leading the team over managing tasks**
- **Adapting to change over conforming to plans**

Agile Manifesto. (2001). Manifesto for agile software development. Retrieved March 21, 2010, from http://www.agilemanifesto.org

DOI. (2005). *Declaration of interdependence*. Retrieved March 21, 2010, from http://www.pmdoi.org

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Scrum Project Management

- Created by Jeff Sutherland at Easel in 1993
- Product backlog comprised of customer needs
- <u>Barely-sufficient project management framework</u>

Schwaber, K. (2004). *Agile project management with scrum.* Redmond, WA: Microsoft Press.

XP Project Management

- Created by Kent Beck at Chrysler in 1998
- Release plan is comprised of customer needs
- Lightweight, rigorous near-term planning element

Beck, K., & Fowler, M. (2001). *Planning extreme programming*. Upper Saddle River, NJ: Addison-Wesley.

Flexible Project Management

- Created by Doug DeCarlo at Cutter in 2004
- Focus is on collaboration, scoping, and speed
- Thinner traditional project management approach

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

Adaptive Project Management

- Created by Sanjiv Augustine at CC Pace in 2005
- Builds agile cultures, mind-sets, and environments
- Leadership model for managing agile project teams

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

Agile Project Management

- Created by Jim Highsmith at Cutter in 2003
- Focus on strategic plans and capability analysis
- <u>Most holistic agile project management framework</u>

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Envision Phase

- Determine product vision and project objectives
- Identifies project community and project team
- <u>The major output is a “Product Vision Box”</u>

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

Speculate Phase

- Determine organizational capability/mission needs
- Identifies feature-sets and system requirements
- <u>The major output is a “System Release Plan”</u>

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

Explore Phase

- Determine technical iteration objectives/approaches
- Identifies technical tasks and technical practices
- <u>The major output is an “Operational Element”</u>

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Adapt Phase

- Determine the effectiveness of operational elements
- Identifies customer feedback and corrective actions
- The major output is a "Process Improvement Plan"

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Close Phase

- Determine project outcome and effectiveness
- Identifies strengths, weaknesses, and rewards
- <u>The major output is a “Lessons-Learned Report”</u>

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Multi-Level Teams

- Enables projects to plan for the future and present
- Decomposes capabilities into implementable pieces
- <u>Unclogs the drainpipes to let the execution flow freely</u>

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

Multi-Level Planning

- Enables multiple level enterprise plans to co-exist
- Allows stakeholders to build viewpoint-specific plans
- <u>Ensures capabilities are delivered at regular intervals</u>

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

Multi-Level Backlog

- Enables multiple levels of abstraction to co-exist
- Allows customers and developers to communicate
- <u>Makes optimum use of people's time and resources</u>

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

Multi-Level Coordination

- Enables lean and agile methods to scale-up
- Allows enterprises to create large-scale programs
- <u>Unleashes optimum productivity and overall control</u>

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

Multi-Level Governance

- Enables enterprises to achieve functional needs
- Allows programs to coordinate functional activities
- <u>Ensures optimal technical performance is achieved</u>

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Basic Agile Metrics

- Agile methods are based on traditional measures
- Size, effort, and velocity metrics are most common
- Top-notch shops use complexity and testing metrics

Type	Example
Size	Story, Story Point, Task, Function Point, LOC, etc.
Effort	Ideal or Actual Hours, Days, Weeks, Months, Years, etc.
Velocity	Story, Story Points, Function Points, or LOC per Iteration/Sprint
Complexity	McCabe, Halstead, Object-Oriented, Relational Database, etc.
Quality	Defect Density, Defect Removal Efficiency, Rayleigh, etc.
Testing	Tests Passed/Failed/Broken, Running Tested Features, etc.
Reliability	Mean Time to Failure, Mean Time between Failure, etc.

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.

Burndown/Burnup Metrics

- Time expended is used for project tracking
- Tracked on a per-iteration or per-sprint basis
- Often described as a basic earned-value metric

Type	Example
Ideal Days	How many days something takes without interruptions
Actual Days	How many days something takes with interruptions
Ideal Hours	How many hours something takes without interruptions
Actual Hours	How many hours something takes with interruptions
User Stories	How many customer requirements have been satisfied
Story Points	How many units of software size have been satisfied
Technical Tasks	How many technical tasks have been completed

Cohn, M. (2006). *Agile estimating and planning*. Upper Saddle River, NJ: Pearson Education.

Agile Cost Models

- Costs based on productivity and quality models
- Development costs based on *LOC* ÷ *productivity* rate
- Maintenance costs based on *defects* × *KLOC* × *MH*

Type	Example
Basic Form	(LOC ÷ Productivity + Quality × KLOC × 100) × Hourly Rate
XP	(LOC ÷ 16.1575 + 0.7466 × KLOC × 100) × Hourly Rate
TDD	(LOC ÷ 29.2800 + 2.1550 × KLOC × 100) × Hourly Rate
PP	(LOC ÷ 33.4044 + 2.3550 × KLOC × 100) × Hourly Rate
Scrum	(LOC ÷ 05.4436 + 3.9450 × KLOC × 100) × Hourly Rate
Agile	(LOC ÷ 21.2374 + 1.7972 × KLOC × 100) × Hourly Rate

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.

Agile Business Value

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

Type	Example
Costs	Total amount of money spent on agile methods
Benefits	Total amount of money gained from using agile methods
Breakeven	Point when the benefits of using agile methods exceed the costs
B/CR	Ratio of agile methods benefits to costs of using agile methods
ROI	Ratio of adjusted agile methods benefits to costs of using them
NPV	Present value of agile methods benefits that result from their use
Real Options	Value gained from incremental investments in high-risk projects

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.

Agile EVM

- EVM has been adapted to Agile Methods
- EVM based on notion that total scope is known
- EVM is “not” well-suited for large-scale agile projects

Type	Example
PMB	Total number of story points planned for a release
SBL	Total number of iterations multiplied by iteration length
BAC	The planned budget for the release
PPC	Number of current iterations divided by planned iterations
APC	Total story points completed divided by story points planned
SPC	Story points of work completed from backlog during iteration
SPA	Story points added/subtracted from backlog during iteration

Sulaiman, T., Barton, B., & Blackburn, T. (2006). Agile EVM: Earned value management in scrum projects. *Proceedings of the Agile 2006 Conference (Agile 2006), Minneapolis, Minnesota, USA, 7-16.*

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E-Commerce—Google

- Google started using agile methods in 2005
- Used it on one of their most profitable products
- Incrementally adopted agile one practice at a time

Project Name	AdWords
Project Type	Pay-per-Click (PPC) Internet Advertising Mechanism
Project Size	20 teams of 140 people distributed over 5 countries
Product Size	1,838 user stories, 6,250 function points, 500,000 lines of code
Environment	Entrepreneurial, egalitarian, dynamic, unpredictable, informal, unstructured
Before APM	Chronic schedule delays, poor quality, unpredictability, poor estimation
APM Practices	Release planning, wikis for APM support, early testing and continuous integration
After APM	Better planning and estimates, earlier testing, better quality, large-scale adoption
Lessons Learned	Agile fit like a hand-in-glove, introduce agile methods slowly and then scale-up

Striebeck, M. (2006). Ssh: We are adding a process. *Proceedings of the Agile 2006 Conference (Agile 2006), Minneapolis, Minnesota, USA*, 193-201.

Shrink-Wrapped—Primavera

- Primavera started using agile methods in 2004
- Used it on their flagship project management tools
- Adopted agile all-at-once with top-down mgt. support

Project Name	Primavera
Project Type	Enterprise Project Management Tool
Project Size	15 teams of 90 people collocated at one site
Product Size	26,809 user stories, 91,146 function points, 7,291,666 lines of code
Environment	Top-down, hierarchical, command and control, traditional, waterfall approach
Before APM	Poor relationships, quality, usability, and customer satisfaction, functional silos, 18-hour days, 7-day work weeks, frustration, disappointment, apathy, exhaustion
APM Practices	Release planning, agile project management tools, automated testing tools
After APM	75% quality and 40% cycle time improvement, 40-hour work week, 0% attrition
Lessons Learned	Agile results in better communication, motivation, and empowerment

Schatz, B., & Abdelshafi, I. (2005). Primavera gets agile: A successful transition to agile development. *IEEE Software*, *22*(3), 36-42.

Healthcare—FDA

- FDA suppliers started using agile methods in 2008
- Used it on most stringent Class 3 certified products
- Used to modernize 1990s era products & processes

Project Name	m2000 Real-time PCR Diagnostics System
Project Type	Human Blood Analysis Tool (i.e., HIV-1, HBV, HCV, CT, NG, etc.)
Project Size	4 teams of 20 people collocated at one site
Product Size	1,659 user stories, 5,640 function points, 451,235 lines of code
Environment	FDA-regulated medical devices, real-time, safety-critical, Class III–most stringent
Before APM	Cumbersome process, poor quality, long cycle time, slow big-bang integration, obsolete, hard-to-staff tools and methods, inability to keep pace with changing requirements, Intense market competition, exponential rate of technological change, fewer resources
APM Practices	Release planning, lighter-weight agile testing techniques, continuous integration
After APM	25% cycle time and staff-size reduction, 43% cost reduction, fewer defects
Lessons Learned	Agile enables the ability to balance fast cycle time with high-quality safety-critical solutions

Rasmussen, R., Hughes, T., Jenks, J. R., & Skach, J. (2009). Adopting agile in an FDA regulated environment. *Proceedings of the Agile 2009 Conference (Agile 2009), Chicago, Illinois, USA*, 151-155.

Law Enforcement—FBI

- IC started using agile methods following 9/11
- Used it on billion dollar transformation initiatives
- Goal is to catch bad guys better, faster, and cheaper

Project Name	Inter-Agency Intelligence Sharing System
Project Type	Domestic Terrorist Database/Data Warehouse
Project Size	3 teams of 12 people collocated at one site
Product Size	643 user stories, 2,188 function points, 175,000 lines of code
Environment	CMMI Level 3, ISO 9001, government-mandated document-driven waterfall life cycle, emerging federal directives for more information sharing and integration among intelligence community partners, rapidly changing customer requirements
Before APM	Unresponsive waterfall life cycles, chronic schedule delays, anxious customers, unhappy developers, resource focus on becoming CMMI Level 3 certified caused everyone to lose track of the real goal, which was to “catch bad guys”
APM Practices	Release planning, user stories, test-driven development, continuous integration
After APM	50% quality improvement, 200% productivity increase, FBI created policy for agile methods
Lessons Learned	Agile enables fast response times, customer satisfaction, and ability to "catch bad guys"

Babuscio, J. (2009). How the FBI learned to catch bad guys one iteration at a time. *Proceedings of the Agile 2009 Conference (Agile 2009), Chicago, Illinois, USA*, 96-100.

U.S. DoD—STRATCOM

- U.S. DoD started using agile methods following 9/11
- Used it on billion-dollar software-intensive systems
- Goals are to respond to rapidly emerging threats

Project Name	Strategic Knowledge Integration Website (SKIweb)
Project Type	Knowledge Management System (KMS)—Advanced Search Capability
Project Size	3 teams of 12 people collocated at one site
Product Size	390 user stories, 1,324 function points, 105,958 lines of code
Environment	Traditional linear documentation-based development, contract-oriented, hierarchical communication, rapidly changing operational requirements, need for leaner U.S. military force, seeking better and faster ways of getting critical information to decision makers, decentralization, migration to net-centric service oriented architectures, egalitarian decisions
Before APM	Long cycle times, dissatisfied customers, unresponsive life cycles, poor quality
APM Practices	Release planning, frequent customer collaboration, continuous integration
After APM	Good teamwork, 200% productivity increase, improved quality, fewer defects
Lessons Learned	Agile improves customer satisfaction/communication, and overall product quality

Fruhling, A., McDonald, P, & Dunbar, C. (2008). A case study: Introducing extreme programming in a U.S. government system development project. *Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008), Waikaloa, Big Island, Hawaii, USA*, 464-473.

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☞ Summary of Agile Project Mgt.

Advanced Agile Measures

- Agile Methods are a fundamentally new paradigm
- Agile Methods are “not” lighter Traditional Methods
- They should not be viewed through a traditional lens

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Benefits of Agile Methods

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

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

Myths about Agile Methods

- Common myths abound, although agile methods have been around for ~20 years:
  - *Agile methods are only for* software development
  - *Agile methods are only for* small co-located teams
  - *Agile methods have* no documentation
  - *Agile methods have* no requirements
  - *Agile methods need* traditional system architectures
  - *Agile methods have* no project management
  - *Agile methods are* undisciplined *and* unmeasurable
  - *Systems built using agile methods are* unmaintainable *and* insecure

Conclusions

- Traditional methods are well-suited for predictability
- Agile Methods are well-suited for high uncertainty
- It comes down to efficiency versus effectiveness

Traditional Project Management	Agile Project Management
• 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.

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

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