

# *Investing in Software Process Improvement: An Executive Perspective*

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## *Executive Priorities*

**What executives care about:**

- **profitability, stock price, revenue, market share, ...**

**Crucial stakeholders:**

- **customers and users**
- **stock holders**
- **employees (technical staff, engineers)**
- **management**

**“What business are we in?”**

**“Are we building (software) products that our customers want to buy?”**

## *What Is Project Success?*

### **Four universal dimensions of success**

- project efficiency
- impact on the customer
- business and direct success
- preparing for the future

### **Four different groups of stakeholders**

- the customer organization
- the developing organization
- the project team
- the end-user

*Aaron J. Shenhar, Ofer Levy, and Dov Dvir, "Mapping the Dimensions of Project Success," Project Management Journal, June 1997.*

## *Shifting Definitions of Success*

The relative importance of project success dimensions changes with time.

During project execution, only three dimensions seem important to project managers:

- to please the prospected customers
- to meet time and budget goals
- to some extent to succeed commercially

Poor project definition and weak articulation of product requirements may result in dissatisfied customers even when the project specifications are fully met.

*Aaron J. Shenhar, Ofer Levy, and Dov Dvir, "Mapping the Dimensions of Project Success," Project Management Journal, June 1997.*

## *The State of the Practice?*

*"I'd rather have it wrong than have it late. We can always fix it later."*

- A senior software manager (industry)

*"The bottom line is schedule. My promotions and raises are based on meeting schedule first and foremost."*

- A program manager (government)

**Standish Group – the Chaos Report**

- 23% of software projects failures (2000)
  - from 31% failures (1994)
- 49% of software projects challenged (2000)
  - from 53% challenged (1994)

*"By regularly putting the development process under extreme time pressure and then accepting poor-quality products, the software user community has shown its true quality standard."*

- DeMarco and Lister (*Peopleware*)

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## *Prioritizing Business Objectives*

Treacy and Wiersma define three values that a company can focus on to drive business success.

***Product leadership*** – features, innovation

- typical focus of commercial shrinkwrap companies

***Customer intimacy*** – niche products, relationships

- typical focus of IT service providers

***Operational excellence*** – promised features, on schedule, on budget

- typical focus of custom software development

*Michael Treacy and Fred Wiersema, The Discipline of Market Leaders, 1997.*

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## *Practical Prerequisites for SPI*

**Are you unhappy with the status quo with respect to software in your organization?**

**Are your customers dissatisfied?**

**Is the competition using software superiority to gain competitive advantage?**

***If the answers are “No,” it is unlikely that***

- your behavior will change ...***
- ... or that your “sponsorship” will inspire change***

## *Managing Improvement*

**Do you have improvement objectives?**

**Do you measure progress toward achieving those objectives?**

**Can you forecast whether you will achieve the objectives?**

- If yes, are you considering what new objectives to establish?**
- If no, what are you doing to take corrective action? Revise plans? Develop a new strategy?**

## *Results Oriented*


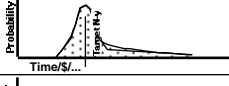
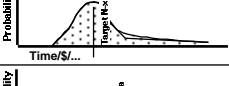
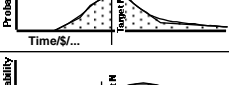
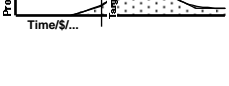
If the business results are not measurably visible as improvement trends...

... then the lack of results signals an approach or deployment problem...

... perhaps resulting from a focus on getting a “level” or “certificate” rather than achieving business objectives.

## *Implications of Maturity*

*Better predictability... Less variability... Improved performance...*

Level	Process Characteristics	Predicted Performance
5 Optimizing	Process improvement is institutionalized	
4 Managed	Product and process are quantitatively controlled	
3 Defined	Software engineering and management processes defined and integrated	
2 Repeatable	Project management system in place; performance is repeatable	
1 Initial	Process is informal and unpredictable	

## *Trends in Software Quality*

<b>Maturity Level</b>	<b>Design Faults / KSLOC (Keene)</b>	<b>Delivered Defects / FP (Jones)</b>	<b>Shipped Defects / KSLOC (Krasner)</b>	<b>Relative Defect Density (Williams)</b>	<b>Shipped Defects (Rifkin)</b>
<b>5</b>	<b>0.5</b>	<b>0.05</b>	<b>0.5</b>	<b>0.05</b>	<b>1</b>
<b>4</b>	<b>1</b>	<b>0.14</b>	<b>2.5</b>	<b>0.1</b>	<b>5</b>
<b>3</b>	<b>2</b>	<b>0.27</b>	<b>3.5</b>	<b>0.2</b>	<b>7</b>
<b>2</b>	<b>3</b>	<b>0.44</b>	<b>6</b>	<b>0.4</b>	<b>12</b>
<b>1</b>	<b>5-6</b>	<b>0.75</b>	<b>30</b>	<b>1.0</b>	<b>61</b>

*Samuel Keene, "Modeling Software R&M Characteristics." Unpublished report.  
 Capers Jones, "Software Benchmarking," IEEE Computer, October 1995.  
 Herb Krasner, "Self-Assessment Experience at Lockheed," Third Annual SEPG Workshop, November 1990.  
 Karl D. Williams, "The Value of Software Improvement... Results! Results! Results!" SPIRE97, June 1997.  
 Stan Rifkin, "The Business Case for Software Process Improvement," Fifth SEPG National Meeting, April 1993.*

## *Trends in Productivity*

<b>Maturity Level</b>	<b>Business Systems PI</b>	<b>Engineering Systems PI</b>	<b>Real-Time Systems PI</b>
<b>2</b>	<b>17</b>	<b>15</b>	<b>9</b>
<b>3</b>	<b>19.5</b>	<b>18</b>	<b>11.5</b>
<b>4</b>	<b>22</b>	<b>20.5</b>	<b>14</b>
<b>5</b>	<b>25</b>	<b>23</b>	<b>16.5</b>

*Lawrence H. Putnam, "Linking the QSM Productivity Index with the SEI Maturity Level," QSM, 2000.*

## Trends in Effort

In COCOMO II, the PMAT variable factors in maturity level in terms of decreasing effort/cost.

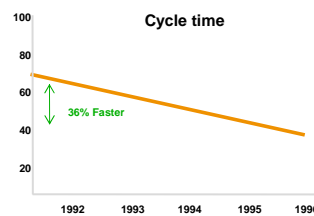
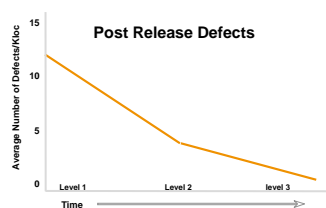
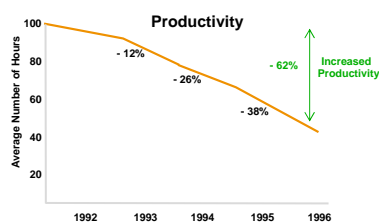
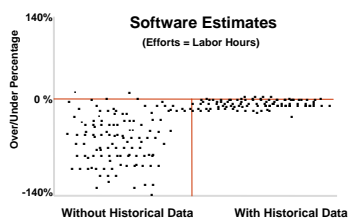
- one level change results in 15-21% decrease in effort

*Bradford K. Clark, "Quantifying the Effects on Effort of Software Process Maturity," IEEE Software, November/December 2000.*

*Donald E. Harter, Mayuram S. Krishnan, and Sandra A. Slaughter, "Effects of Process Maturity on Quality, Cycle Time, and Effort in Software Product Development," Management Science, April 2000.*

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## Impact of SPI: Boeing Data



*John Vu, "Software Process Improvement Journey (From Level 1 to Level 5)," SEPG Conference 1997.*

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## *Impact of SPI: Motorola Global Software Group*

Attribute	1993	1995	2000	Industry Average
Delivered Quality Level	5.1 $\sigma$	5.7 $\sigma$	5.9 $\sigma$	4.3 $\sigma$
Cost of Poor Quality	35%	17%	6-8%	40%
Relative Productivity	1.5X	2.2X	2.6-6X	1X
Cycle Time Improvement	2.75X	4.4X	6X+	N/A

*Robert Yacobellis, "Panel: Does SEI Level 5 Lead to High Quality Software?" COMPSAC 2001.*

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## *Empirical Data on Improvement Per Level*

**Quality (reliability, defects) improves by roughly a factor of 2 (or more)**

- *Capers Jones, "Software Benchmarking," IEEE Computer, October 1995.*
- *Karl D. Williams, "The Value of Software Improvement... Results! Results! Results!" SPIRE97, June 1997.*
- *Robert Yacobellis, "Panel: Does SEI Level 5 Lead to High Quality Software?" COMPSAC 2001.*

**Effort for a given product decreases 15-21%, productivity increases, cycle time decreases**

- *Bradford K. Clark, "Quantifying the Effects on Effort of Software Process Maturity," IEEE Software, November/December 2000.*
- *Donald E. Harter, Mayuram S. Krishnan, and Sandra A. Slaughter, "Effects of Process Maturity on Quality, Cycle Time, and Effort in Software Product Development," Management Science, April 2000.*
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## *The Dangers of Fire Fighting*

**Firefighting is a self-reinforcing syndrome**

- even a temporary increase in workload can initiate the firefighting dynamic and cause a permanent decline in system performance

**People overweight the short-run positive benefits of their decisions while ignoring the long-run negative consequences**

- “better-before-worse” behavior in short term created by firefighting

*Nelson P. Repenning, Paulo Goncalves, and Laura J. Black, “Past the Tipping Point: The Persistence of Firefighting in Product Development,” California Management Review, Vol. 43, No. 4, Summer 2001.*

## *Processes That “Last”*

**Deal with the normal day-to-day work, with waivers for exceptional conditions (common sense!)**

**Are defined by the people doing the work**

**Contain the minimum essential information to do the job**

**Balance discipline with creativity**

**Are supported by both tools and culture**

**Are continually improving**

## *What Are the Benefits of Model-Based Improvement?*

**Forge a shared vision of improvement**

**Establish a common language for improvement**

**Build on a set of processes and practices developed with input from a broad section of the software community**

**Provide a framework for prioritizing actions**

**Provide a framework for performing reliable and consistent appraisals**

**Support industry-wide comparisons**

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## *What Are the Risks of Model-Based Improvement?*

**Models are simplifications of the real world.**

**Models are not comprehensive.**

**Interpretation and tailoring must be aligned to business objectives.**

**Judgement is necessary to use models correctly and with insight.**

**Potential for dysfunctional behavior to get a maturity level rating.**

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*Let Common Sense Prevail!*

		Process Discipline	
		Yes	No
Common Sense	Yes	<b>Quality</b>	<b>Creative Chaos</b>
	No	<b>Mindless Bureaucracy</b>	<b>Mindless Chaos</b>

*With thanks to Sanjiv Ahuja, former President and COO of Telcordia Technologies.*