

The Early Warning Signs of IT Project Failure: *The Deadly Dozen & The Four Horsemen of Doom*

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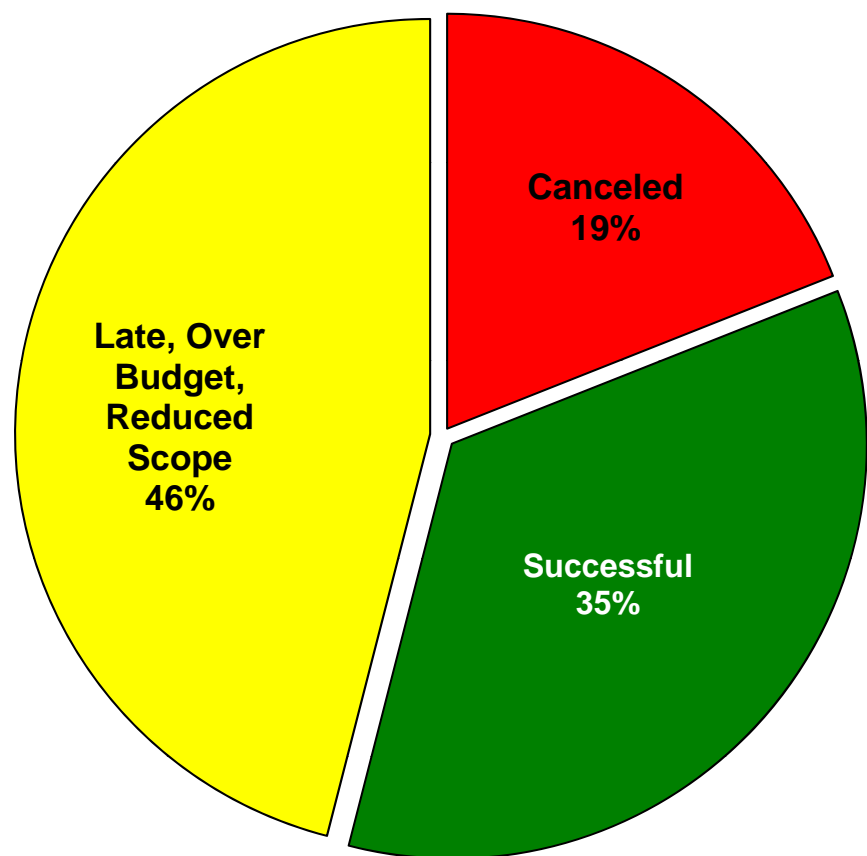
No Shortage of Major IT Project Failures

- **FoxMeyer Drugs ****
- **Denver Airport Baggage**
- **Internal Revenue Service**
- **Dept. of Veterans Affairs**
- **London Stock Exchange**
- **Bank of America**
- **Hershey Foods**
- **American LaFrance ****
- **McDonalds**
- **Shane ****
- **KMart ****
- **Nike**
- **AMR**
- **FAA**
- **FBI**
- **IRS**

FoxMeyer Drugs – a \$5 billion annual revenue drug distributor. First billion dollar bankruptcy due to a failed IT project.

**** = IT directly implicated in bankruptcy.**

The Continuing IT Project Challenge



- ❖ 19% canceled - “outright failure”
- ❖ 46% “cost or time overruns ... didn’t fully meet user’s needs”
- ❖ Only 35% completed on time, on budget, with promised functionality
- ❖ Initial performance & reliability are often less than expected & needed
- ✓ **Cancellation rate increases w/size:**
 - 32% large projects cancelled (> 10K FPs)
 - 52% very large (> 100K FPs)

FPs = Function Points
Capers Jones, 2009

Why Focus on Early Warning Signs?

The Cost of an Error (Hay, 2003)

\$1	Strategic Planning
\$5	Requirements Analysis
\$20	Design
\$100	Construction
\$500	Transition
\$1000	Production

- The cost of fixing an error rises dramatically over time.

Requirements – “No other part of the work so cripples the system if done wrong. No other part is more difficult to rectify later.”

– Fred Brooks, *No Silver Bullets* (1986)

- Human Nature
 - IT people are optimists
 - Escalation Theory
 - Admitting wrong/don't know
 - Sunk cost
 - Job security
 - Recency bias

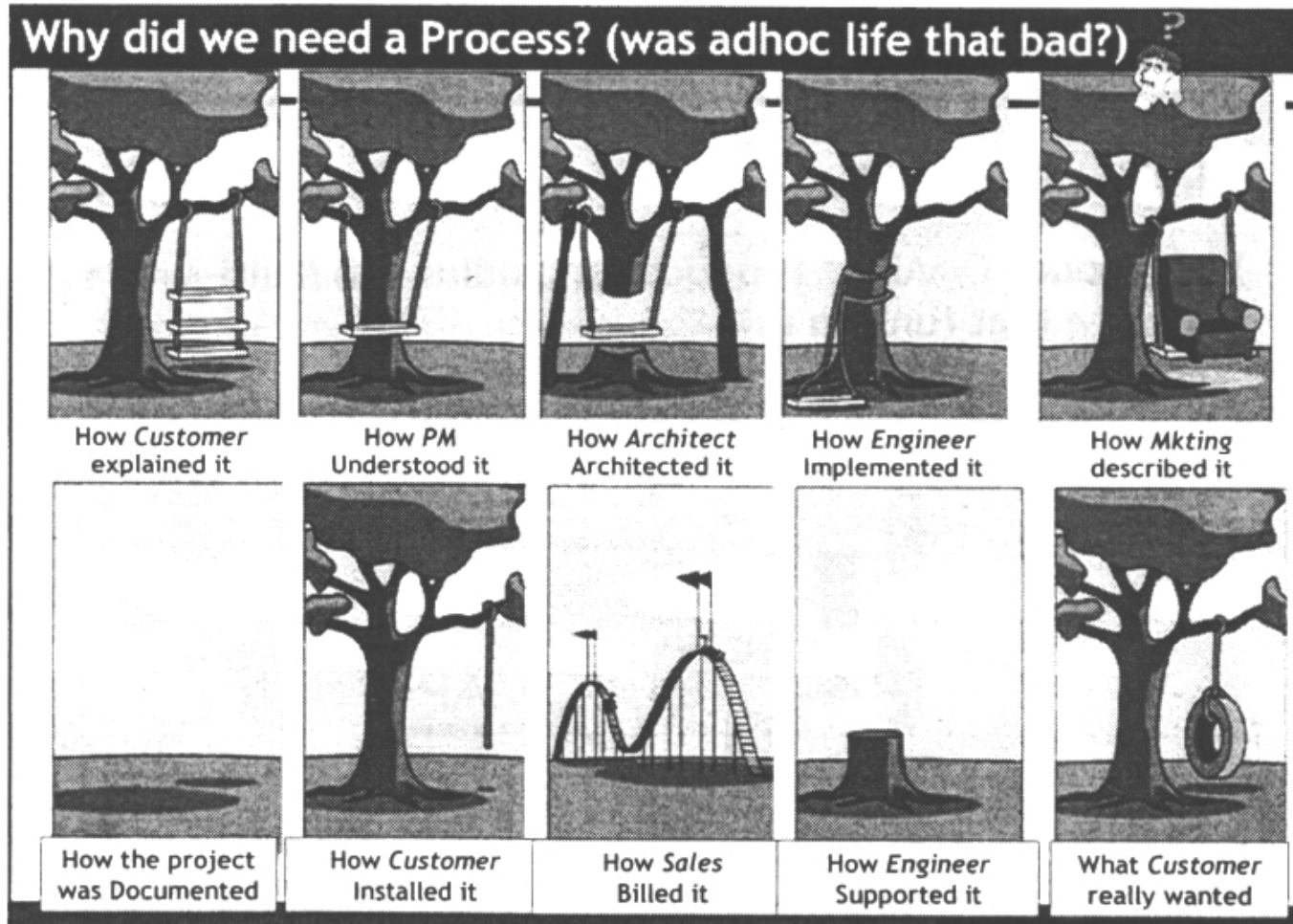
***What are the sources
of IT project risk?***

Three Main Sources of IT Project Risk

- **People**
- **Process**
- **Product**

Requirements Ain't Easy!

Perspectives of People Vary – a lot



Cook, M. (Speaker). (26 February 2005). *Scorecards and Behavior Checklists as a Method of Measuring Process Deployment Across the Organization* [presentation]. Plano, TX: SEI Software Engineering Process Improvement Workshop, EDS Auditorium.

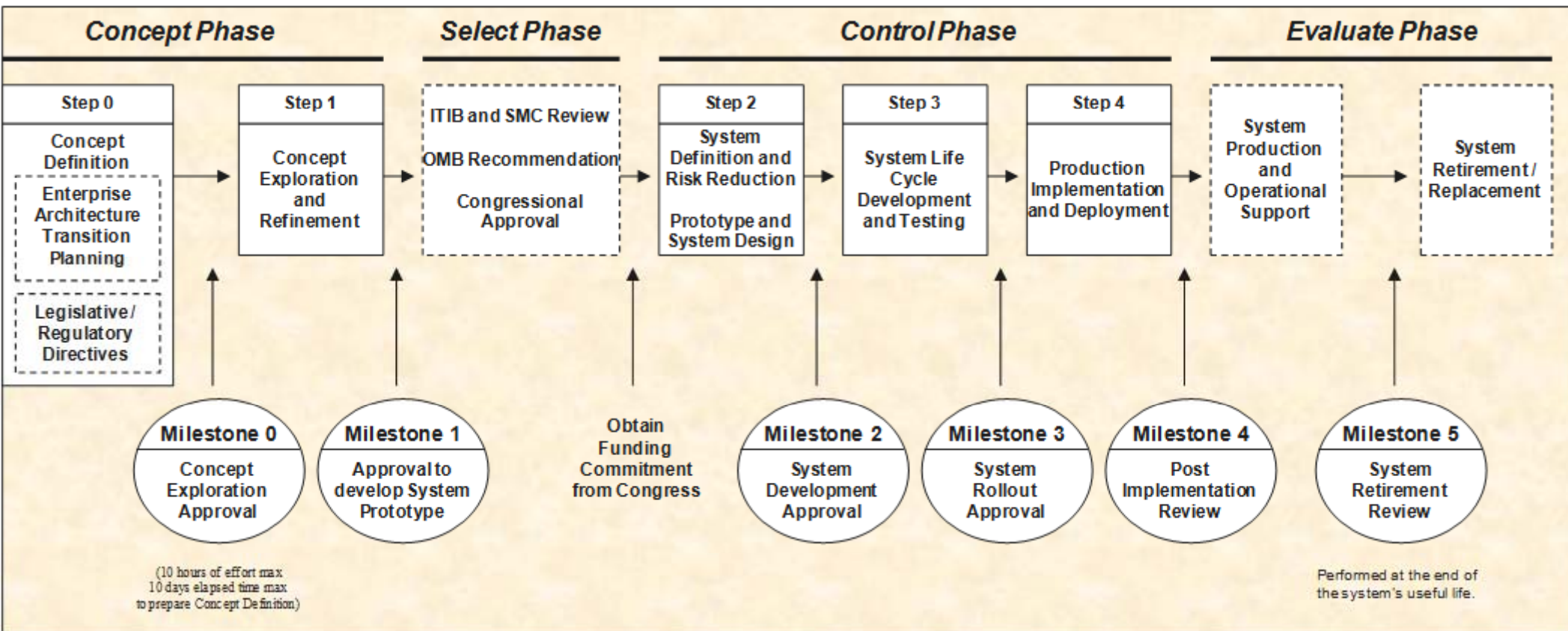
Requirements change at an average rate of 1.6% per month (1K to 10K FPs), or about 34% over the life of a 10,000 FP project (Capers Jones, 2008)



PROCESS IS CRITICAL

MILESTONES & INSPECTIONS MATTER!

When you've completed a step and are ready to progress into your next step, you must hold a Project Decision Meeting and get the MDA's approval to continue.



Project Size Matters!

Probability of Selected IT Project Outcomes

Table 1 uses six size ranges each an order of magnitude apart. Table 1 is taken from the author's book, Patterns of Software Systems Failure and Success (International Thomson Press, 1996).

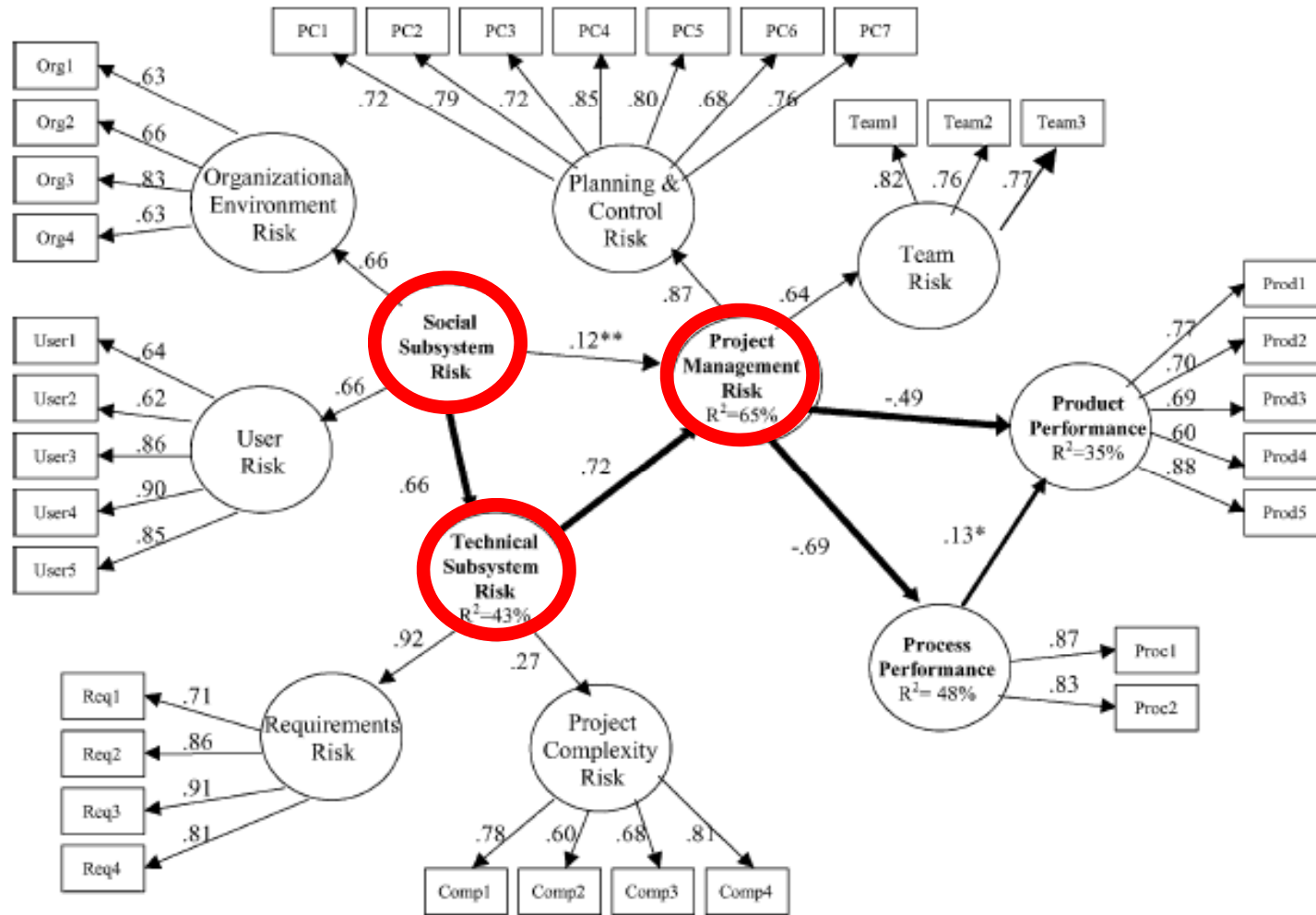
Table 1: Software Project Outcomes By Size of Project

PROBABILITY OF SELECTED OUTCOMES					
	Early	On-Time	Delayed	Canceled	Sum
1 FP	14.68%	83.16%	1.92%	0.25%	100.00%
10 FP	11.08%	81.25%	5.67%	2.00%	100.00%
100 FP	6.07%	74.77%	11.83%	7.33%	100.00%
1000 FP	1.21%	60.76%	27.61%	20.33%	100.00%
10000 FP	0.11%	28.03%	43.83%	48.00%	100.00%
100000 FP	0.00%	13.67%	21.33%	65.00%	100.00%
Average	5.53%	56.94%	13.71%	23.82%	100.00%

As can easily be seen from table 1, small software projects are successful in the majority of instances. The risks and hazards of cancellation or major delays rise quite rapidly as the overall application size goes up. Indeed, the development of large applications in excess of 10,000 function points is one of the most hazardous and risky business undertakings of the modern world.

Source: Capers Jones (1996)

Figure 5: SEM analysis results.

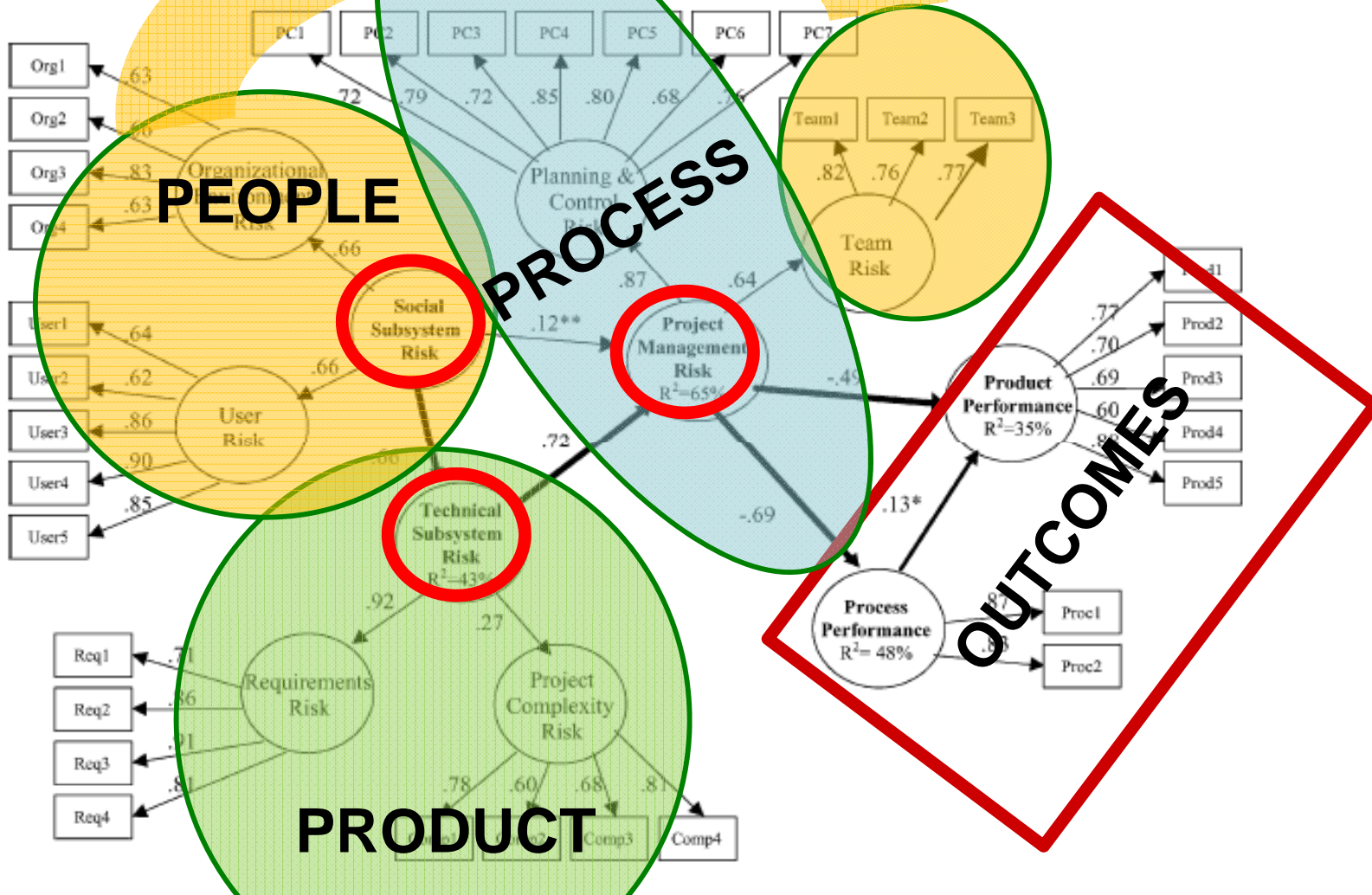


All paths were significant at $p < .001$ unless noted.

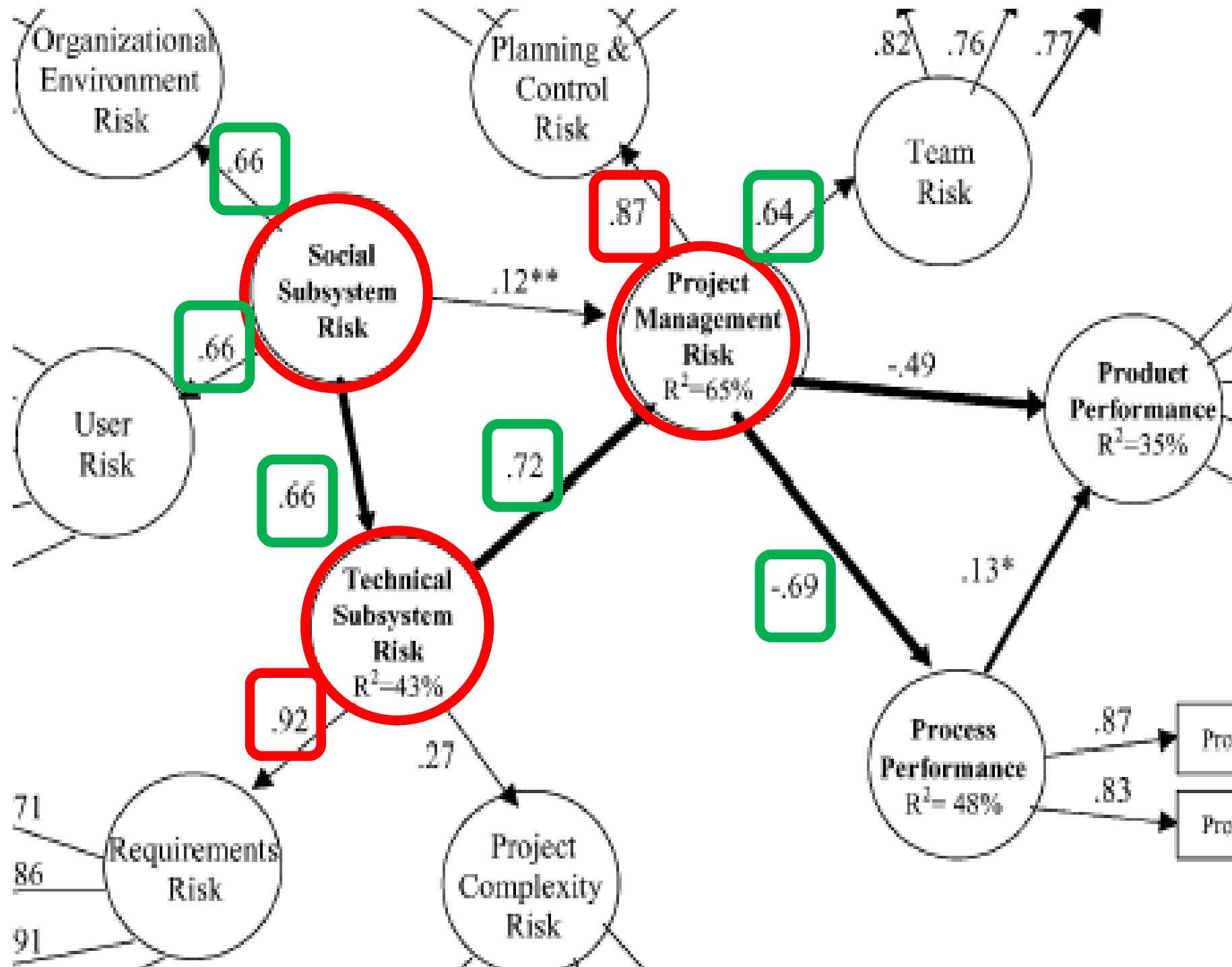
*denotes that the path was significant at $p < .05$.

**denotes an insignificant path.

Figure 5: SEM analysis results.



All paths were significant at $p < .001$ unless noted.
 *denotes that the path was significant at $p < .05$.
 **denotes an insignificant path.



***What do we know
about managing IT
project risk?***

**Project
Management
Body of
Knowledge**

**Integration
Management**

- Plan Development
- Plan Execution
- Integrated Change Control

**Scope
Management**

- Initiation
- Scope Planning
- Scope Definition
- Scope Verification
- Scope Change Control

**Time
Management**

- Activity Definition
- Activity Sequencing
- Activity Duration Estimating
- Schedule Development
- Schedule Control

**Cost
Management**

- Resource Planning
- Cost Estimating
- Cost Budgeting
- Cost Control

**Quality
Management**

- Quality Planning
- Quality Assurance
- Quality Control

**Human
Resources
Management**

- Organizational Planning
- Staff Acquisition
- Team Development

**Communications
Management**

- Communications Planning
- Information Distribution
- Performance Reporting
- Administrative Closure

**Risk
Management**

- Risk Management Planning
- Risk Identification
- Qualitative Risk Analysis
- Quantitative Risk Analysis
- Risk Response Planning
- Risk Monitoring and Control

**Procurement
Management**

- Procurement Planning
- Solicitation Planning
- Solicitation
- Source Selection
- Contract Administration
- Contract Closeout

Best Practices are Known

Figure 3: Classic Mistakes and Best Practices Matrix

Classic Mistakes		Best Practices									
		Agile Development	Communication Plan	Estimate-Convergence Graph	Joint Application Development (JAD)	Project Management Charter	Retrospectives	Staged Delivery	Stakeholder Assessment	Work Breakdown Structure	
1	Poor estimation and/or scheduling	X		X		X	X	X	X		X
2	Ineffective stakeholder management		X		X	X	X			X	
3	Insufficient risk management			X		X	X	X	X		
4	Insufficient planning			X		X	X	X			X
5	Shortchanged quality assurance	X			X				X		
6	Weak personnel and/or team issues	X	X				X	X	X		
7	Insufficient project sponsorship		X		X	X	X			X	
8	Poor requirements determination	X			X						X
9	Inattention to politics		X			X	X			X	
10	Lack of user involvement	X	X		X				X	X	

Retrospectives conducted in 74 organizations over the prior seven (7) years

Source: R. Ryan Nelson (2007)

Tools Can Help

RESULTS >10,000 FUNCTION POINT PROJECTS

Probability of Selected Outcomes

	Cancel	Delays	On time	Early
Automated estimates	1%	2%	78%	19%
Automated plans				
Formal tracking				
Optimal quality control				
Manual estimates	40%	45%	15%	0%
Manual plans				
Informal tracking				
Minimal quality control				

Source: Capers Jones (1996)

EWS Research Goal

Identify relative importance of Early Warning Signs (EWS) of impending IT Project Failure within the first 20% of the original project schedule ... While there is still time to get back on track to success at a reasonable cost.

IT Project Success is defined as being completed on-time, on-budget, with the originally promised functionality and necessary performance and reliability, all adjusted accordingly for changes in requirements.

Our Research Approach: Three Phases

- 1. Extensive literature search**
- 2. Panel of 15 Experts - Delphi Study**
- 3. Survey of senior IT project managers**
 - Average 15 years experience**
 - Maximum project size of \$3 million to \$7 billion**

Survey

- **53 possible Early Warning Sign factors**
- **People, Process, and Technology EWS**
- **Developed an on-line survey tool**
- **Rank each EWS factor from 1 to 7**
 - 1 – Extremely Unimportant**
 - 7 – Extremely Important**

A complete description of the research and findings is in “Early Warning Signs of IT Project Failure” *Information Systems Management*, Fall 2006) – <http://courses.unt.edu/kappelman/aboutwork/articles/ISM%20-%20EWS%20DD.pdf>.

EWS Research Findings

- 17 (out of 53) with a mean score > 6 (out of 7)
- These 17 consolidated down to a Top 12 –
The “Deadly Dozen” Early Warning Signs
- No Technical factors made the top 40
- Technical Factors were all in the bottom 20%

IT projects almost never fail because of technical causes, despite the fact that people and process problems may manifest technically.

The technical ailments of IT projects can be traced to people and process causes that exploit inherent product risks, such as large size, high complexity, or novel technology. Nevertheless, these technical risks can be mitigated with proper people and process practices.

Even risks of large size projects, which are technical (product) risks, can be mitigated by good process and people.

Early Warning Signs “Deadly Dozen”

People Factors

Center on five not altogether mutually exclusive groups of people: Top Management, Project Management, Project Team Members, Subject Matter Experts (SMEs = users), & Stakeholders in general.

- 1. Lack of Top Management Support**
- 2. Weak Project Manager**
- 3. No Stakeholder involvement and/or participation**
- 4. Weak Commitment of Project Team members**
- 5. Team Members lack requisite knowledge or skills**
- 6. Subject Matter Experts are over-scheduled**

Early Warning Signs “Deadly Dozen”

Process Factors

Center on five project management processes and their associated deliverables that are essential to success: Requirements (including a Business Case), Change Control, Schedule Control, Communications, and Resources.

- 1. Lack of Documented Requirements / Success Criteria**
- 2. No Change Control Process**
- 3. Ineffective Schedule Planning / Management**
- 4. Communications Breakdown among Stakeholders**
- 5. Resources assigned to a higher priority project**
- 6. No Business Case for the Project**

The Early Warning Signs of IT Project Failure

The Deadly Dozen EWSs	The Four Horseman of IT Project Doom			
	Stakeholders	Requirements	Processes	Team
<i>People-Related Risks</i>				
1. Lack of top management support.	X			
2. Weak project manager.				X
3. No stakeholder involvement.	X			
4. Weak commitment of project team.				X
5. Team members lack requisite knowledge and/or skills.				X
6. Subject matter experts overscheduled.	X			
<i>Process-Related Risks</i>				
7. Lack of documented requirements and/or success criteria.		X		
8. No change control process or change management.			X	
9. Ineffective schedule planning and/or management.			X	
10. Communication breakdown among stakeholders.			X	
11. Resources assigned to higher priority project.		X		
12. No business case for the project.		X		

“Material Financial Risks of IT Projects: The Early Warning Signs of Failure” by Leon A. Kappelman, 2010, *The Interpreter*.

Fred Brooks on the difficulties of software development...

“The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements.... No other part of the work so cripples the system if done wrong. No other part is more difficult to rectify later.”

"No Silver Bullet - Essence & Accidents of Software Engineering"

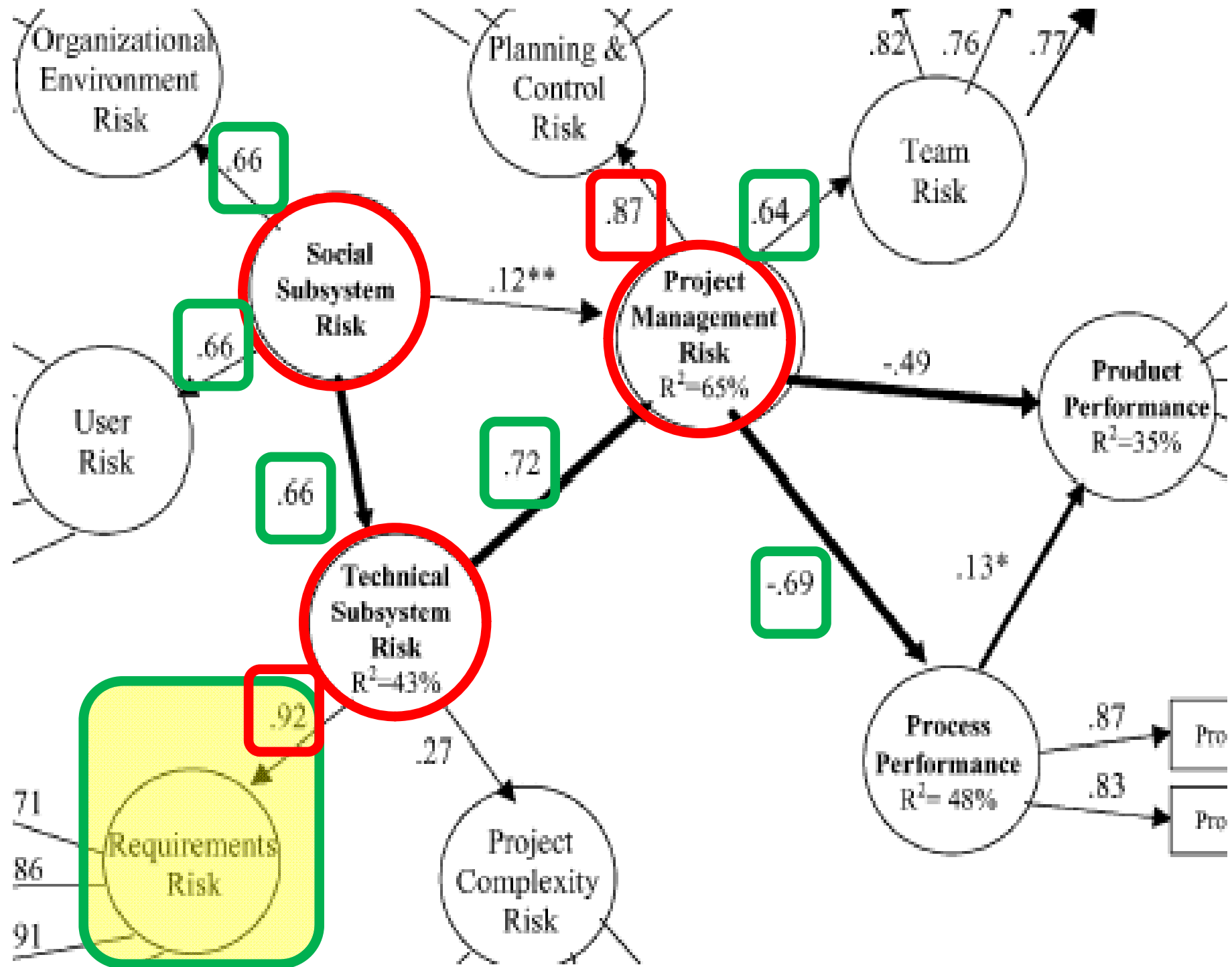
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Reprinted in *The Mythical Man-Month, 20th Anniversary Edition*, Frederick P. Brooks, Jr., Addison-Wesley, 1995.

Why do we need requirements?



Failure to plan is a plan for failure

***Requirements? We
know how to do that,
don't we?***



SIMEAWG

IT Management Practices Study

Averages (Scale: 1 [=awful] to 5 [=superior])

- **3.67 Overall average** (64 questions)
- **3.92 Purpose / function of EA** (7 questions)
- **3.90 Potential benefits of EA** (20 questions)
- **3.68 ISD CMM practices and capabilities** (12 questions)
- **3.53 Use of requirements artifacts** (10 questions)
- **3.33 Requirements practices & capabilities** (15 questions)

The SIM Guide to Enterprise Architecture: Creating the Information Age Enterprise, 2010, edited by Leon A. Kappelman, CRC Press, Taylor and Francis Group, NYC, (www.crcpress.com).

INDUSTRY DATA ON DEFECT ORIGINS

Because defect removal is such a major cost element, studying defect origins is a valuable undertaking.

IBM Corporation (MVS)

45%	Design errors
25%	Coding errors
20%	Bad fixes
5%	Documentation errors
<u>5%</u>	Administrative errors
100%	

SPR Corporation (client studies)

20%	Requirements errors
30%	Design errors
35%	Coding errors
10%	Bad fixes
<u>5%</u>	Documentation errors
100%	

TRW Corporation

60%	Design errors
<u>40%</u>	Coding errors
100%	

Mitre Corporation

64%	Design errors
<u>36%</u>	Coding errors
100%	

Nippon Electric Corp.

60%	Design errors
<u>40%</u>	Coding errors
100%	

U.S. AVERAGES FOR SOFTWARE QUALITY

(Data expressed in terms of defects per function point)

<u>Defect Origins</u>		<u>Defect Potential</u>	<u>Removal Efficiency</u>	<u>Delivered Defects</u>	
Requirements	45%	1.00	77%	0.23	56%
Design		1.25	85%	0.19	
Coding		1.75	95%	0.09	
Documents		0.60	80%	0.12	
Bad Fixes		<u>0.40</u>	<u>70%</u>	<u>0.12</u>	
TOTAL		5.00	85%	0.75	

(Function points show all defect sources - not just coding defects)

BEST IN CLASS SOFTWARE QUALITY

(Data expressed in terms of defects per function point)

<u>Defect Origins</u>	Defect Potential	Removal Efficiency	Delivered Defects
Requirements	0.40	85%	0.08
Design	0.60	97%	0.02
Coding	1.00	99%	0.01
Documents	0.40	98%	0.01
Bad Fixes	<u>0.10</u>	<u>95%</u>	<u>0.01</u>
TOTAL	2.50	96%	0.13
	50%		17%

OBSERVATIONS

Most often found in systems software > SEI CMM Level 3

Fred Brooks on the difficulties of software development...

“The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements.... No other part of the work so cripples the system if done wrong. No other part is more difficult to rectify later.”

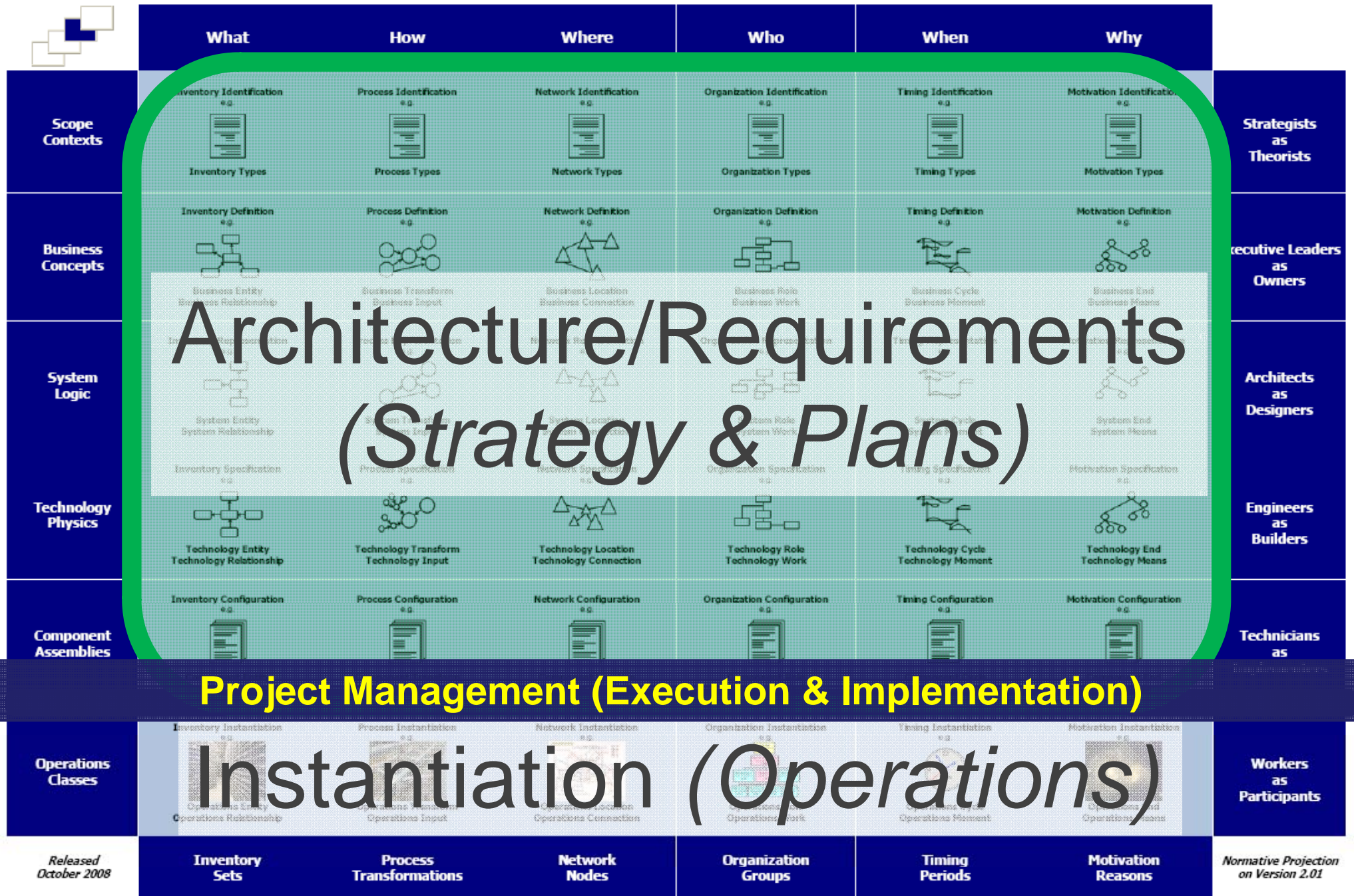
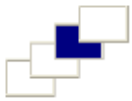
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**The act of discovery
consists not in
finding new lands
but in seeing with
new eyes.**

– Marcel Proust

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October 2008

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Early Warning Signs of IT Project Failure

Four Horseman of Doom

•Requirements

- Lack of documented requirements and/or success criteria
- Resources assigned to a higher priority project
- No business case for the project

•Stakeholders

- Lack of top management support
- No stakeholder involvement and/or participation
- Subject matter experts are overscheduled

•Project Team

- Weak project manager
- Weak commitment of project team
- Team members lack requisite knowledge and/or skills

•Project Management Processes

- No change control process or change management
- Communication breakdown among stakeholders
- Ineffective schedule planning and/or management

There is Still No Silver Bullet



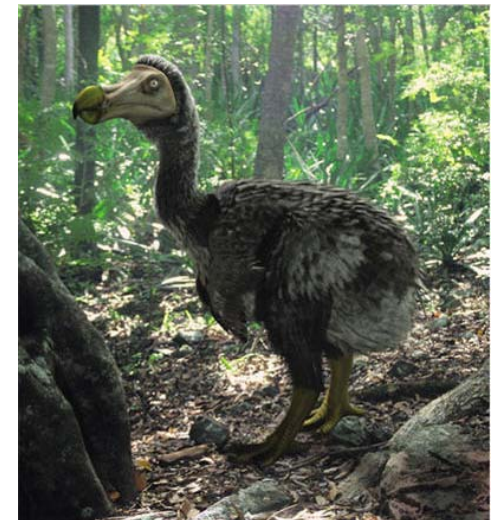
- ✓ **BUT the warning signs are clear -- if you are willing to look.**
- ✓ **Although denial is real since it is very hard for project stakeholders and participants to be objective.**
- ✓ **Hope is not a strategy, but that is too often the strategy.**
- ✓ **Success requires objectivity, candor, smarts, hard work, courage, and hard choices.**

What can you do?

- **Pay attention! – See with “new eyes”**
- **Make all stakeholders aware of EWS risks from the beginning – feasibility, planning, funding.**
- **Outside experts can be helpful & objective**
 - **When it’s tough for stakeholders to be objective.**
 - **When knowledge transfer desired.**
- **If EWSs are identified, then ask:**
 - **How can the EWS be fixed, managed, mitigated?**
 - **Is the business case still valid?**
 - **Is stopping the project the best answer?**
 - *Sunk costs are sunk – throwing good money after bad is foolish.*
 - *Human behavior is sometimes obtuse – Escalation Theory (and market bubbles) – but you don’t have to be “stupid on purpose.”*
- **Candor + Courage = Credibility = Career**

**“No one has to change.
Survival is optional.”**

– Dr. W. Edwards Deming



The SIM Guide to Enterprise Architecture

Creating the Information Age Enterprise

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