
POMS Applied Research Challenge

Managing Risks in Federal Government Technology Projects: Does Process Maturity Matter?

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Motivation: Federal IT Projects

Federal IT initiatives organized in the form of large IT projects



U.S. DEPARTMENT OF
ENERGY



- Healthcare Marketplace Implementation
Department of Health & Human Services
- Navigation systems for missiles
Department of Defense (DOD)
- Web-based SCM system
Department of Agriculture (USDA)

Federal IT Portfolio

26 Agencies, 7248 IT investments

Annual Budget ≈ \$79 Billion

Office of Mgmt. & Budget (OMB) 2011 Report

Motivation: Project Risks in Federal IT Projects

Risk management presents a dominant challenge
in Federal IT projects (McKinsey 2012 Study)

Fiscal Year	Number of major federal technology projects	Associated Budget (\$ in Billions)	Number of Management Watch List projects	Associated Budget (\$ in Billions)	% of federal technology projects on Management Watch List	% of budget
2004	1400	\$59.0	771	\$20.9	55%	35%
2005	1200	60.0	621	22.0	52	37
2006	1087	65.0	342	15.0	31	23
2007	857	64.0	263	9.9	31	15
2008	840	65.0	346	14.0	41	22
2009	810	70.7	585	27.0	72	38



TRENDING: Sequestration Fed 100 Oversight Cyber Policy

POLICY MANAGEMENT EXECUTECH WHO&WHERE THE

White House targets 26 high-risk IT programs for fixes

Projects span 15 departments and would cost \$30B if continued

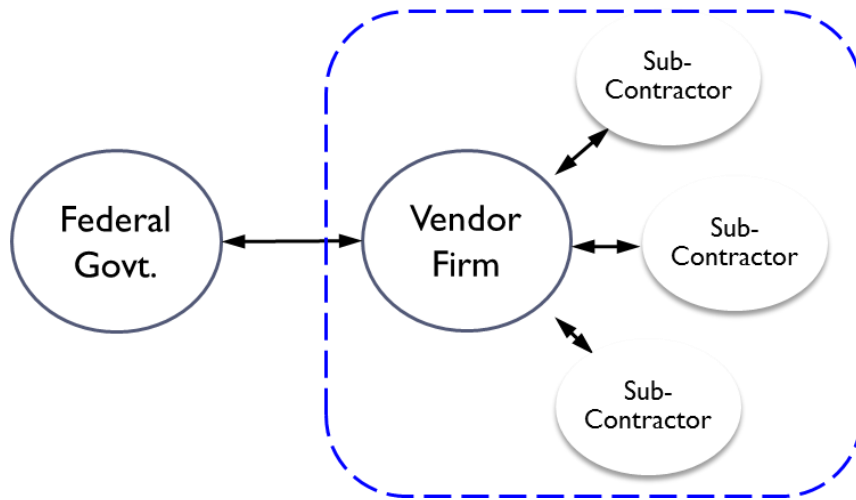
White House targets \$30 Billion (72%) in high-risk IT programs (Federal Computer Week 2010)

Motivation: Legislations and Standards

Year	Legislations/Standards	Purpose
1993	Government Performance & Results Act (GPRA)	To set goals, measure results, and report progress
1993	Federal Acquisition Streamlining Act (FASA)	For bidding and the contracting process for Federal investments
1996	Clinger-Cohen Act (CCA)	To clearly link IT investments and accomplishments
1998	ANSI/EIA-748 Earned Value Management Standard	For evaluating project progress and performance
2002	E-Government Act	Establishes a Federal CIO within the OMB

“As the Obama administration steps up oversight...contracting organizations must take greater responsibility...That is where one of the latest offerings from the Software Engineering Institute can help”
(Federal Computer Week 2010)

Motivation: Focus on Process Maturity



- Key criteria for awarding Federal IT contracts (Brown 2007)
- Recognized as a measure of vendors ability to deliver mission-critical IT solutions (Ramasubbu et al. 2008, Krishnan et al. 2000)



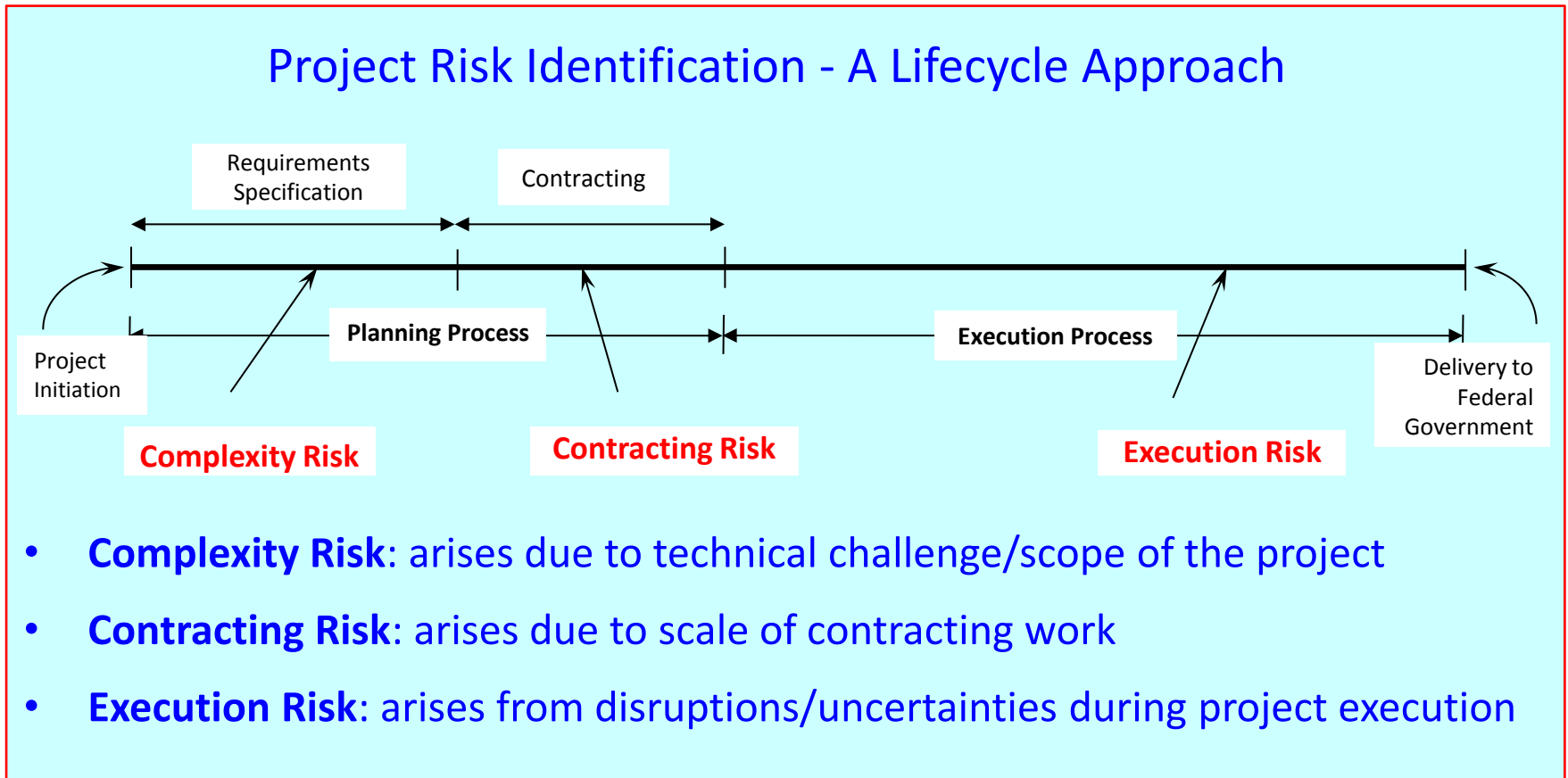
Capability Maturity Model Integrated - Formal process model for managing IT projects

SEI CMMI Levels	
Level 5	Optimizing
Level 4	Quantitatively Managed
Level 3	Defined
Level 2	Managed
Level 1	Initial

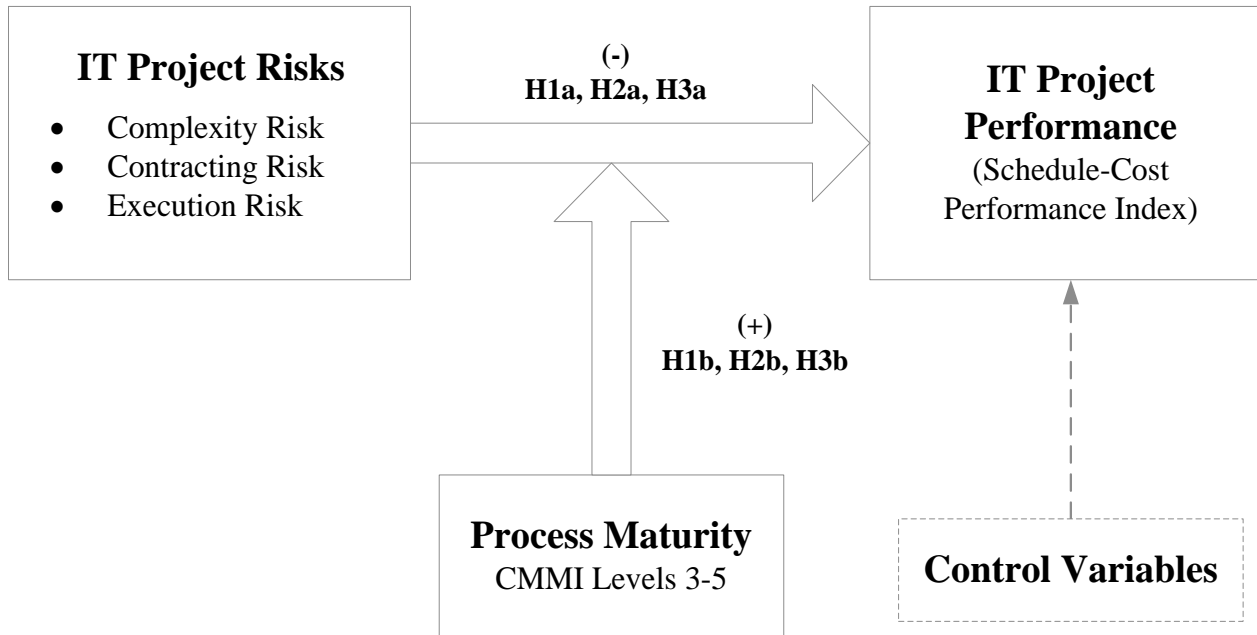


Purpose of the Study

1. Identify Key Risks in Federal Technology Projects, and
2. Examine the Role of Process Maturity in Mitigating Project Risks



Conceptual Framework: Hypotheses



Impact of Process Maturity

- Enables **codification** of an organization's information and risk management practices, enables ease of **information retrieval** and **information processing**
- Provides guidelines for vendor selection – reduces adverse selection issues
- **Systematic monitoring** of problem solving efforts by project team

Research Context: Lockheed Martin



- Fortune 100 High-Tech Firm
- Defense, Aerospace and Security Systems
- Domestic presence (500 facilities)
- Global presence (75 countries)

82 IT Projects over 519 quarters

Project Characteristics (Median values)

- Project Team Size – 40 (FTE)
- Project Budget – \$35 million (Max = \$1.5Billion)
- Project Duration – 5 Quarters (~15 months)
- Project Subcontracting – 20%
- Number of Subcontractors – 2



Research Design: Key Variables

	Mean	Std. Dev
Schedule-Cost Performance Index (SCPI)		
• Schedule Performance Index	0.91	0.13
• Cost Performance Index		
Complexity Risk		
• Project Uncertainty (1 = Low, 3 = Med, 5 = High)	3.10	1.19
• Project Scope (1 = Assembly, 3 = System, 5 = Array)		
Contracting Risk		
• Sub-contracting %	1.18	2.28
• Number of Sub-contractors		
Execution Risk		
• Number of execution risks on risk register	17.70	20.21
Process Maturity		
• CMMI Level 3, CMMI Level 4, CMMI Level 5		

1993 Government Perf. & Results Act (GPRA)

1998 ANSI/EIA-748 Earned Value Management Standard

Control Variables

- Project Team Size
- Project Budget
- Project Labor
- Project Priority
- Customer Review
- Change Order

Econometric Analysis: Results

Independent Variables	Column 1	Column 2	Column 3
Program Risks			
Complexity Risk		-1.158***	-4.203**
Contracting Risk		0.633	-1.625†
Execution Risk		-4.288**	-4.453**
Process Maturity Level			
CMMI Level 4		-0.345*	-0.353
CMMI Level 5		-2.827***	-3.082***
Interaction Effects			
Complexity Risk × CMMI4			4.358***
Complexity Risk × CMMI5			3.660***
Contracting Risk × CMMI4			8.414***
Contracting Risk × CMMI5			2.813**
Execution Risk × CMMI4			-1.056
Execution Risk × CMMI5			2.695**
Chi-Square	149.87***	313.64***	342.06***
df	8	13	19
Δ Chi-Square	--	163.77***	28.42***
Program-Quarter	519	519	519
Program	82	82	82

Main Effects

H1a: Complexity Risk
H1b: Contracting Risk
H1c: Execution Risk



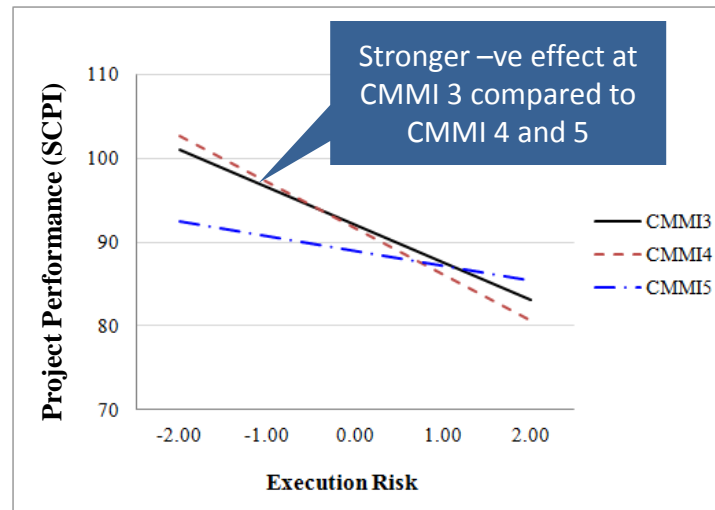
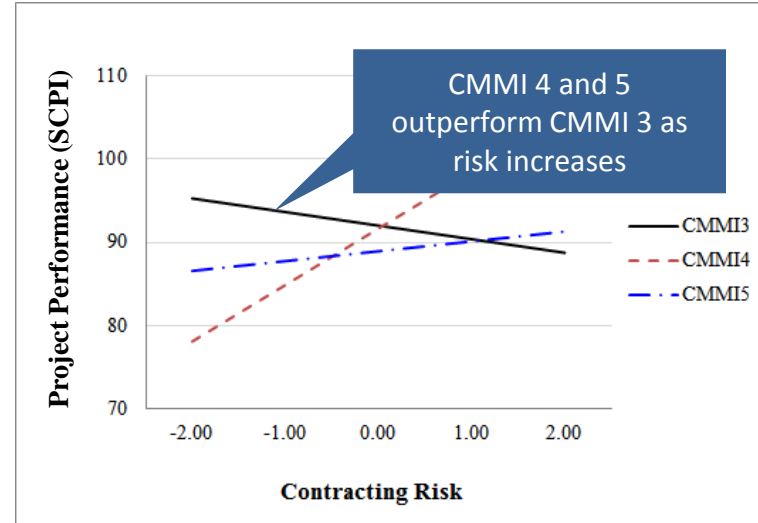
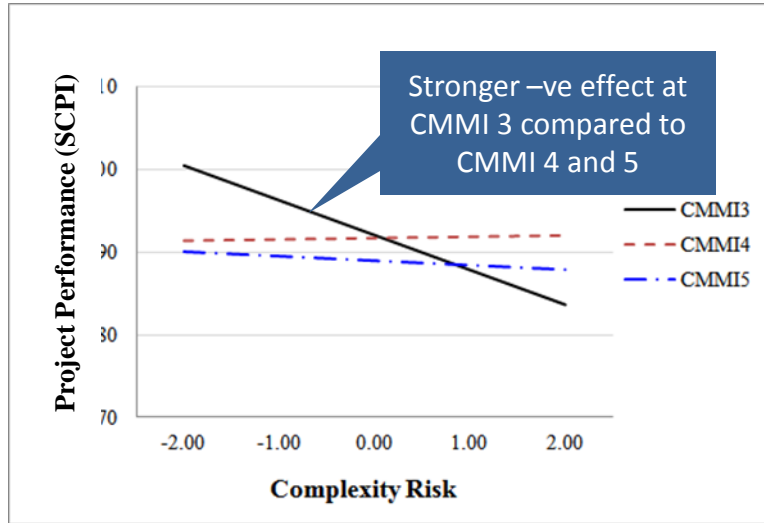
Interaction Effects

H2a: Complexity Risk
H2b: Contracting Risk
H2c: Execution Risk



*p<0.1, **p< 0.05, ***p < 0.01

Analysis: Interaction Effects



Analysis: Financial Implications

Potential Overrun/Underruns:
Median Project Budget = \$35 Million

Risk Levels (in Mean ± SD)		Project Performance (in SCPI)						
		CMMI 3	CMMI 4	CMMI 5	ΔSCPI		ΔEAC*	
					CMMI 4 – 3	CMMI 5 – 3	CMMI 4 – 3	CMMI 5 – 3
Low	-2.00	112.86	89.09	91.44	-23.77	-21.42	-\$8.27 Million	-\$7.26 Million
Average	0.00	92.30	91.95	89.22	-0.35	-3.08	\$0.14 Million	-\$1.31 Million
High	2.00	71.74	94.81	87.00	23.07	15.26	\$11.87 Million	\$8.56 Million

*ΔEAC – Estimated Savings at Completion

Conclusion – Key Findings and Contributions

- **Develop a Framework for Examining Risks in Federal IT Projects**
 - Contributes to the scant empirical literature on Federal IT projects
 - Complexity Risks and Execution Risks have significant negative impact on Project Performance
- **Examining the Role of Process Maturity Model in Mitigating Performance Risks**
 - Questions the notion that mature processes are always better
 - Significant negative direct effects of process maturity
 - Benefits of process maturity manifest when project risks are high

Maturity Levels and Federal IT Projects

Low
Risk

Project Risks
Complexity Risk, Contracting Risk, Execution Risk

High
Risk

Where CMMI 3 is more likely to be beneficial

- **Fiber-optic Motion Sensor** for Joint Strike Fighter, Hubble Telescope
- **GPS Module** for Surface-to-Air Missile
- **Web interface** for 2013 Health Insurance Marketplace



Where CMMI 4, 5 is more likely to be beneficial

- **Navigation System** for Joint Strike Fighter, Hubble Telescope
- **Altitude Control System** for Surface-to-Air Missile
- **Implementation** of 2013 Health Insurance Marketplace

Stay at CMMI Level 3 ? Or Move to Levels 4 and 5?

- Beyond Level 3, organizational processes are onerous
 - Tail wags the dog (large Program Management Office)
- Large overheads tax Federal IT projects
- Many government agencies (and clients) cannot participate at Level 5
- Moving to Levels 4 and 5—Is it worth it during “sequestration” ?

Decision should be based on
project risk portfolio



Problems with Project Assessment Systems

- In Practice Managerial Reporting of Risk
 - Primarily uses Traffic Light Approach (R,Y,G)
- Balanced Scorecard Approach
 - Trade-off consistency and relevance to programs
- Sifting data to get at the right data
- Management, Risk Process are linked but vary
 - depending upon management perspective:
 - strategic, tactical, or sponsor



Over reliance on CMMI Metrics can be
Counterproductive

Evolution of IT and PM Processes

Complexity, Contracting, and Execution Risks will Persist!

- **Evolution of IT Processes**

Agile emphasis (today)

- Focus on demonstrated value “up-front”
- Can CMMI be tailored to Agile?

- **Evolution of PM Processes**

- Firms need to use a portfolio of PM processes
- New methods require organizational “tailoring”

Federal Contractors needs to assess both IT and PM processes to remain competitive



PM processes must be aligned with IT processes and risk

Prescriptions for Practice

- **Study provides insights into the context of Federal IT projects**
 - which are largely understudied in research and practice
 - \$80 billion/year of tax-payer contributions invested in federal IT projects
- **Identify a Framework for Classifying Project Risks**
 - Use an intuitive framework for identifying project risks
 - Focus on Complexity and Execution Risks as they have strong negative effects on performance
- **Does Process Maturity Matter? Higher CMMI levels reduce these negative effects**
 - CMMI 3 is more likely to be beneficial at low risk projects
 - CMMI 4 and 5 are more beneficial at high risk projects

**Get to level 3. Then decide on going to higher levels –
based on project risk portfolio**

Questions



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