Lean Enablers for Managing Engineering Programs

Presented by

David Meza

To

INCOSE Texas Gulf Coast Chapter

April 18, 2013

Agenda

- Overview of Coordinating Organizations
- Motivation – Why do we need "Lean Enablers"?
- Development process
- Applicability: Managing Engineering Programs
- Lean Thinking
- Results: Guide to Lean Enablers for Managing Engineering Programs
- Engineering Program Challenges
- Examples of Lean Enablers
- Lean Enablers and Program Success
- Implementing Lean Enablers

Overview Of The Coordinating Organizations

The LAI Operating Model

Consortium Members

- Executive Board
- Champions
- Membership fee

- LAI Faculty and Researchers
- LAI Students
- LAI Research Project Portfolio

- LAI Educational Network

Sponsored Research Programs

- Focused research
- By members and non-members

LAI Research Portfolio - Excerpt

Managing Large-scale Engineering Programs

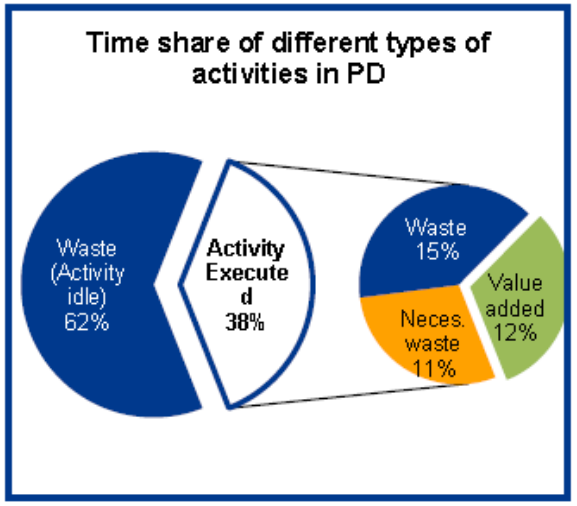
- Practically all aspects of managing large engineering over the last 15 years
- Lean Engineering Program Management
- Risk management in large engineering programs

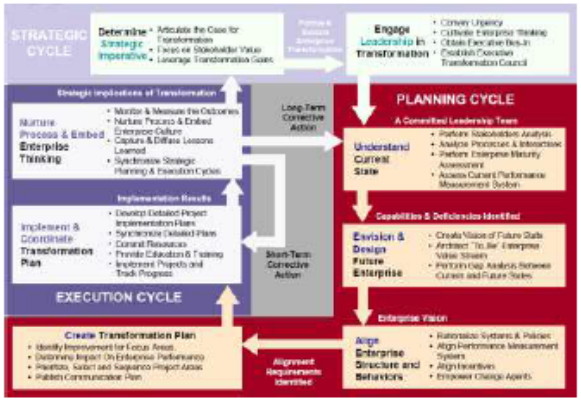
Enterprise Change Management

- (Program) Enterprise transformation framework "ESAT"
  - Book: "Beyond the Lean Revolution"
- Implementing Lean Engineering Practices

Managing Public Service Programs

- Reforming the military "Post Traumatic Stress Disorder" treatment program
  - Part of a $150 billion enterprise
  - Several hundred organizations





International Council on Systems Engineering (INCOSE)

- Not-for-profit membership organization
- 8000+ members

- Develop and disseminate the interdisciplinary principles and practices that enable the realization of successful systems
- Share, promote and advance the best of systems engineering from across the globe for the benefit of humanity and the planet.

- Systems Engineering Handbook v. 3.2.2, consistent with ISO/IEC 15288:2008

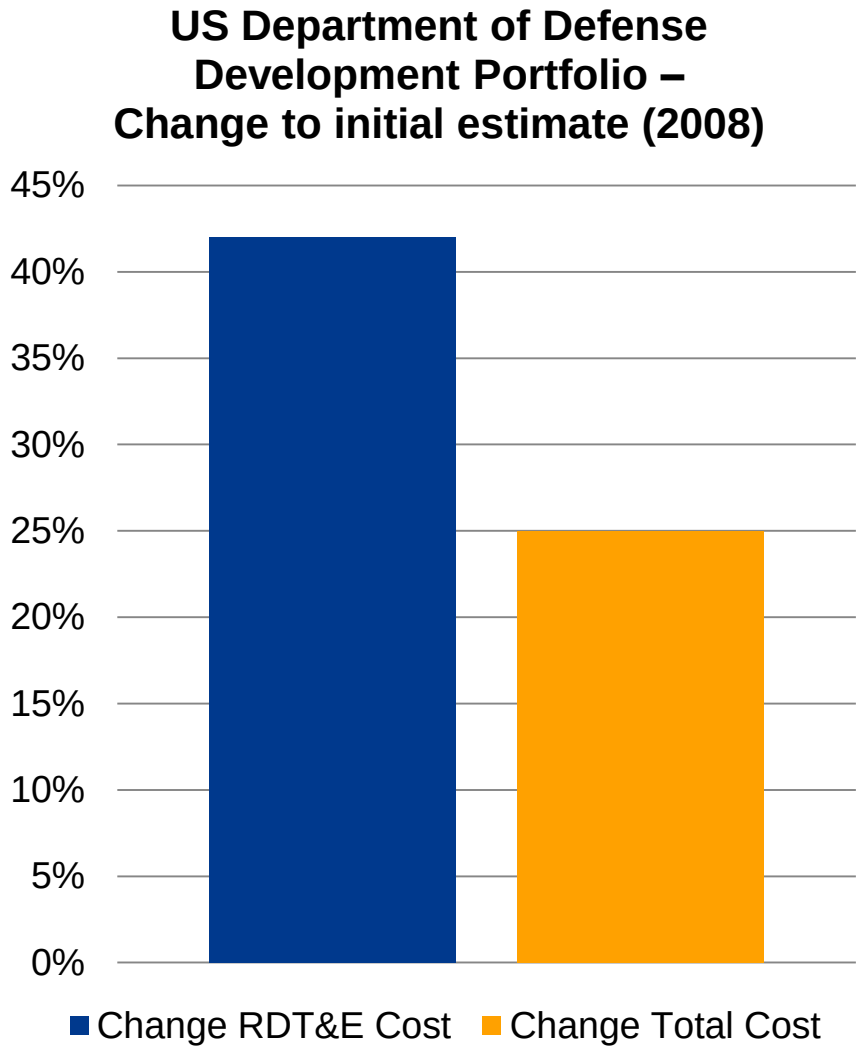
- January: International Workshop
- July: International Symposium
- www.incose.org

Project Management Institute (PMI)

- World's leading not-for-profit membership association for the project management profession
- More than 600,000 members and credential holders in more than 185 countries.
- "Products":
  - globally-recognized standards,
  - credentials, and
  - professional development opportunities
- Standards
  - Guide to the Project Management Body of Knowledge
  - Standard for Program Management
  - Standard for Portfolio Management
  - Organizational Project Management Maturity Model (OPM3)
  - Various practice standards, frameworks and standards extensions

MOTIVATION

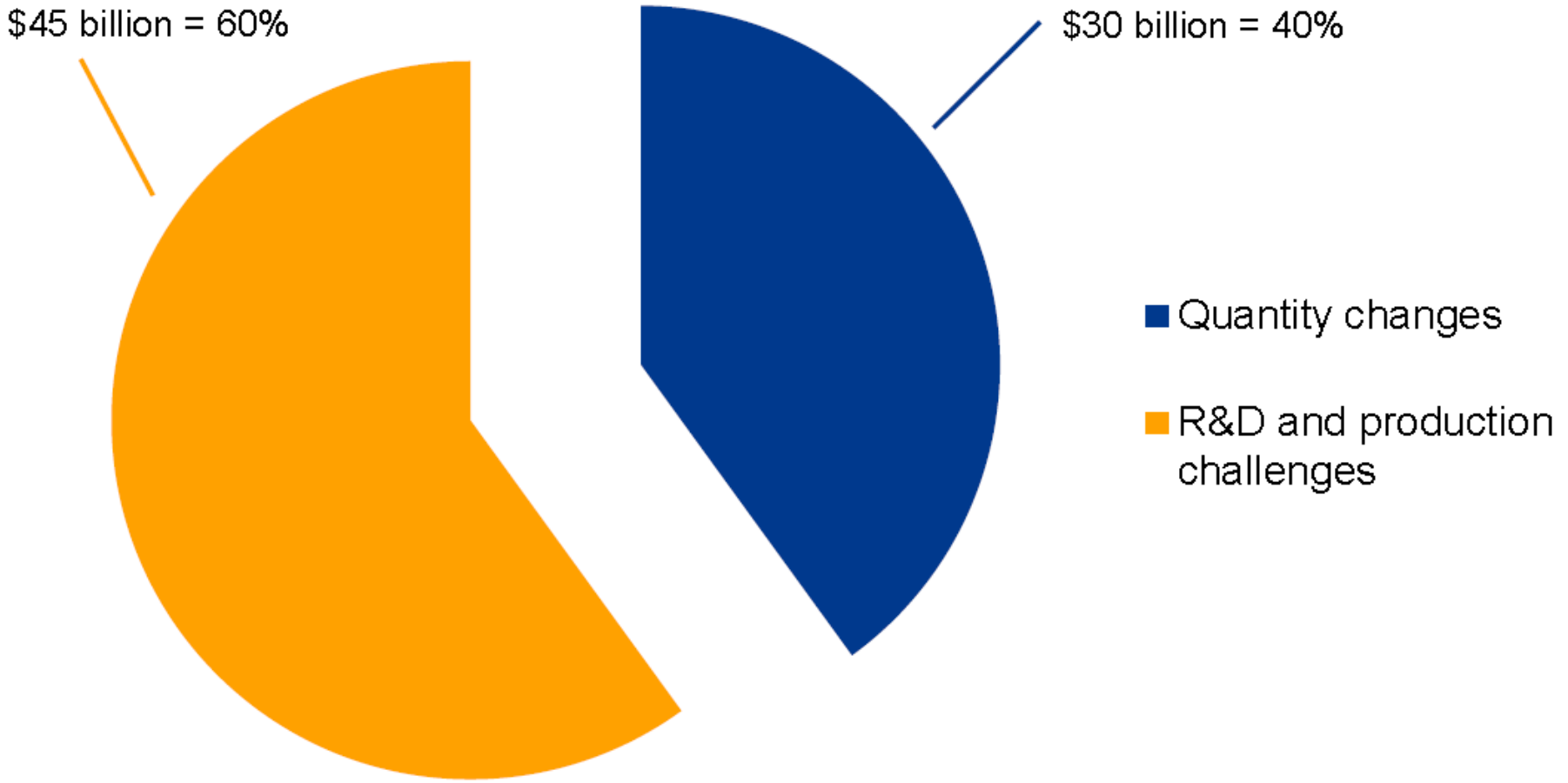
Management of Large-Scale Engineering Programs: DOD Example



- Total cost growth: **$296 billion**
- Average schedule overrun: **22 months**
- Similar situation in other industries

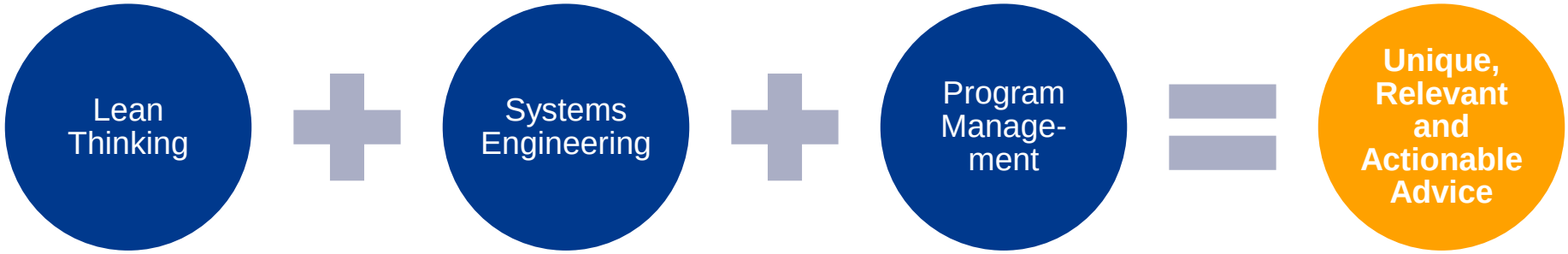
Sources: GAO 06-368, Bloomberg, GAO 10-374T

DoD Cost Growth 2011: $75 billion



Source: GAO-12-400SP

Study Design: Innovation by Bridging Knowledge Domains



Unique	Relevant	Actionable
• Three world-class organizations and thought leaders joined forces • Industry, government and academia participation	• Massive challenges in program execution: Cost and schedule overruns • Integration of knowledge and professional domains • Extensively validated	• Concrete advice • Mapped to known challenges and existing standards • Guidance for implementation

2 Core Results:

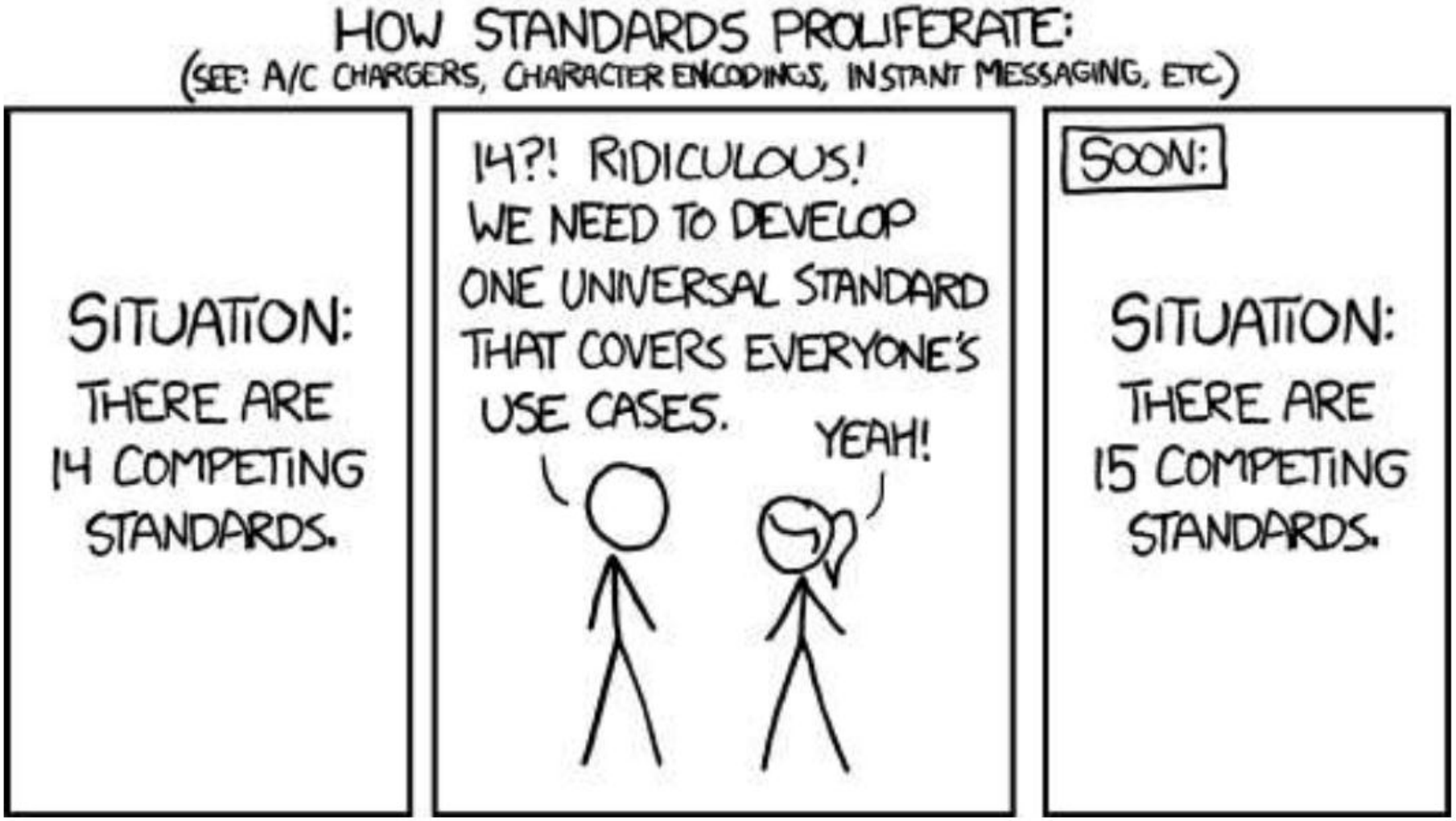
- 160 **Program Management Challenges** in 10 Themes
- 300 **Lean Enablers** (= Management Best Practices) in 40 areas

What is a serious engineering program challenge in your organization?

1. Reactive Program Execution
2. Lack of stability, clarity and completeness of requirements
3. Insufficient alignment and coordination of the extended enterprise
4. Value stream not optimized throughout the entire enterprise
5. Unclear roles, responsibilities and accountability
6. Insufficient team skills, unproductive behavior and culture
7. Insufficient Program Planning
8. Improper metrics, metric systems and KPIs
9. Lack of proactive management of program uncertainties and risks
10. Poor program acquisition and contracting practices

DEVELOPMENT PROCESS

Goal: Supporting Existing Standards
in Program Management and Systems Engineering



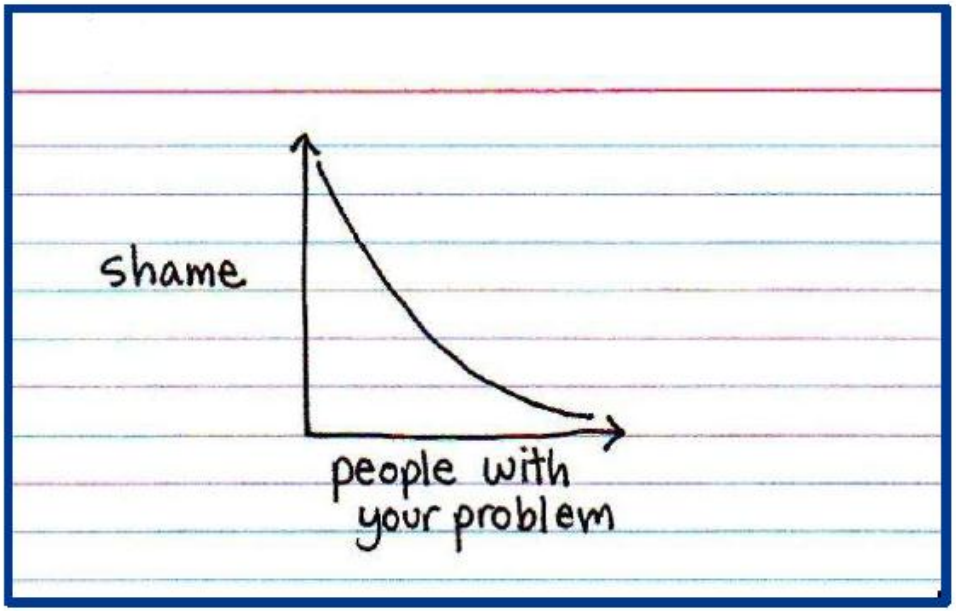
Source: Randall Munroe, www.xkcd.com

Joint INCOSE-PMI-MIT Lean in Program Management Community of Practice

Key Driver: Industry Need

Lean in Program Management Community of Practice – Who we are

- January 2011 – March 2012
- Conduct a study within 1 year, that
  - Identifies the key challenges in managing engineering programs and
  - Identifies and documents best practices to overcome these challenges
- Ensure highest possible degree of applicability and practicality by
  - Focusing on needs of program managers from industry and government,
  - Develop the results through a group of subject matter experts and
  - Validate the results extensively.



Source: indexed.com

From 0 to …
140+ current members representing 35+ organizations

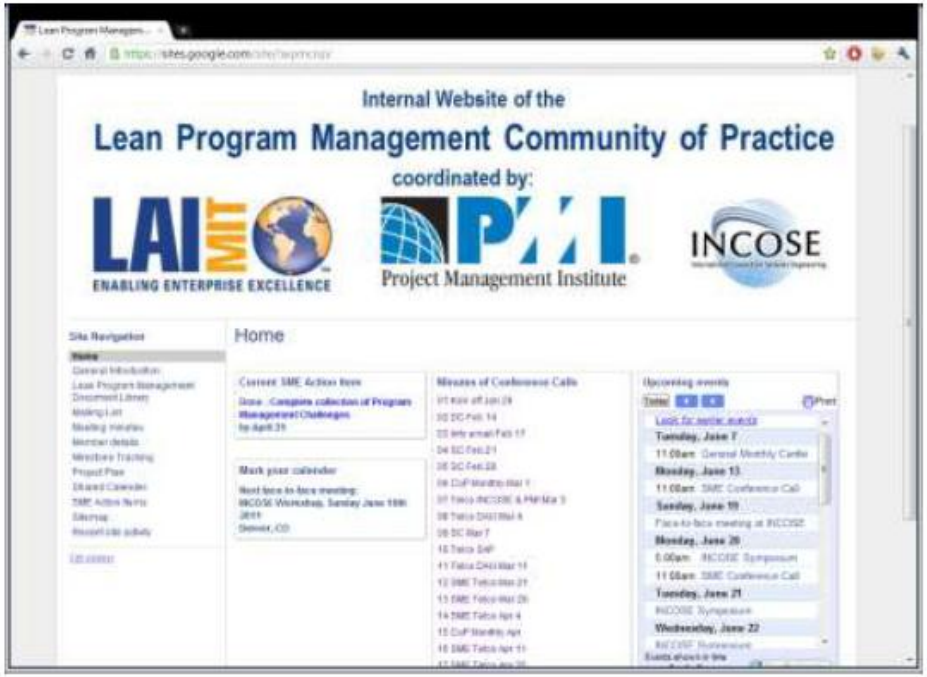
Development Process

- Based on **concrete challenges**, not thin air
- Incorporates **start-of-the-art knowledge** from literature
- Developed by group of 15 **subject matter experts** through year-long, weekly meetings
- Feedback through wider **community of practice** (100+ members)
- Discussed at **4 large and very successful workshops**, involving both PMI and INCOSE members
- Backed-up by **two validation surveys**
- Validated by **content analysis** management practices of highly successful programs

Websites

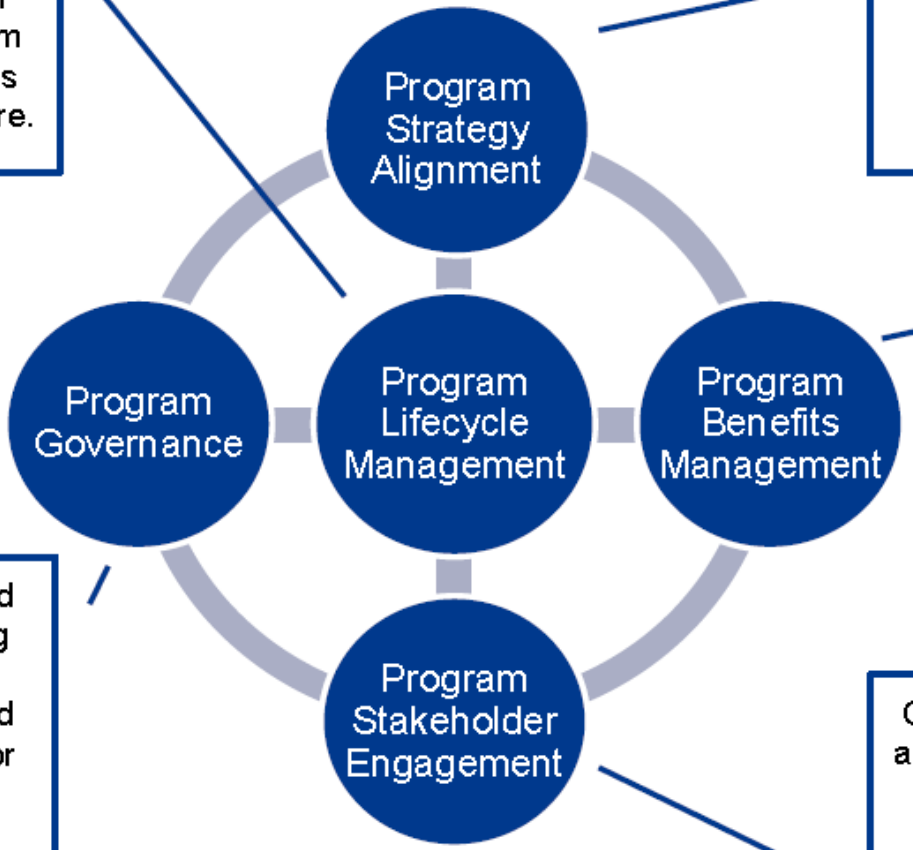
Public website:
www.lean-program-management.org

Internal website



APPLICABILITY: MANAGING ENGINEERING PROGRAMS

5 Program Management Performance Domains



Managing all the program activities related to program definition, program benefits delivery and program closure.

Identifying opportunities and benefits that achieve the organization's strategic objectives through program implementation.

Defining, creating, maximizing, and sustaining the benefits provided by programs.

Establishing processes and procedures for maintaining pro-active program management oversight and decision-making support for applicable policies and practices throughout the entire program life cycle

Capturing stakeholder needs and expectations, gaining and maintaining stakeholder support, and mitigating / channeling opposition.

Applicability – Program Types

Focus	Technology, engineering, infrastructure	Business transformation	Community & Society
	• Large-scale engineering programs (e.g. aerospace, defense, civil engineering, product line)	• Organizational change programs (e.g. institutionalizing continuous improvement, implementing cost cutting measures)	• Public management programs (e.g. reducing childhood obesity, reforming military healthcare)
	• Large-scale IT development and implementation programs (e.g. change of ERP system, virtualization of entire software)		

Applicability – Engineering Systems Life Cycle

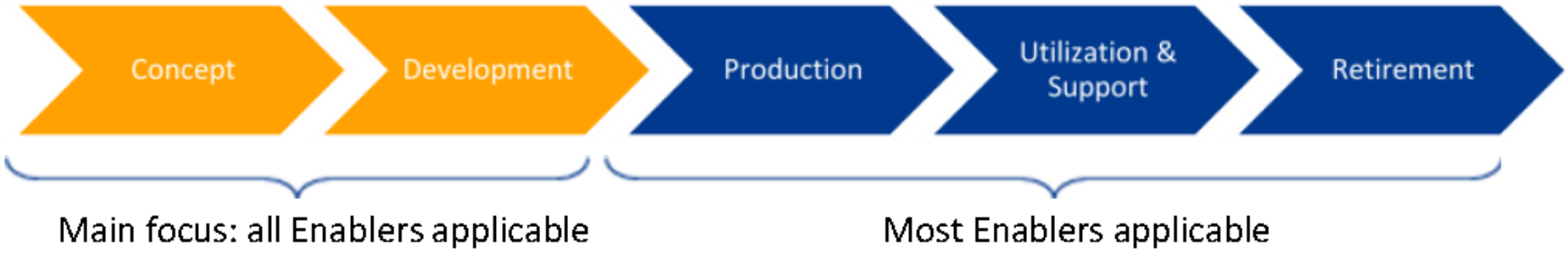


Figure 1: Life-Cycle Phases of an Engineering System and Applicability of Lean Enablers

Table 1: Applicability of Lean Enablers in System Life-Cycle Phases

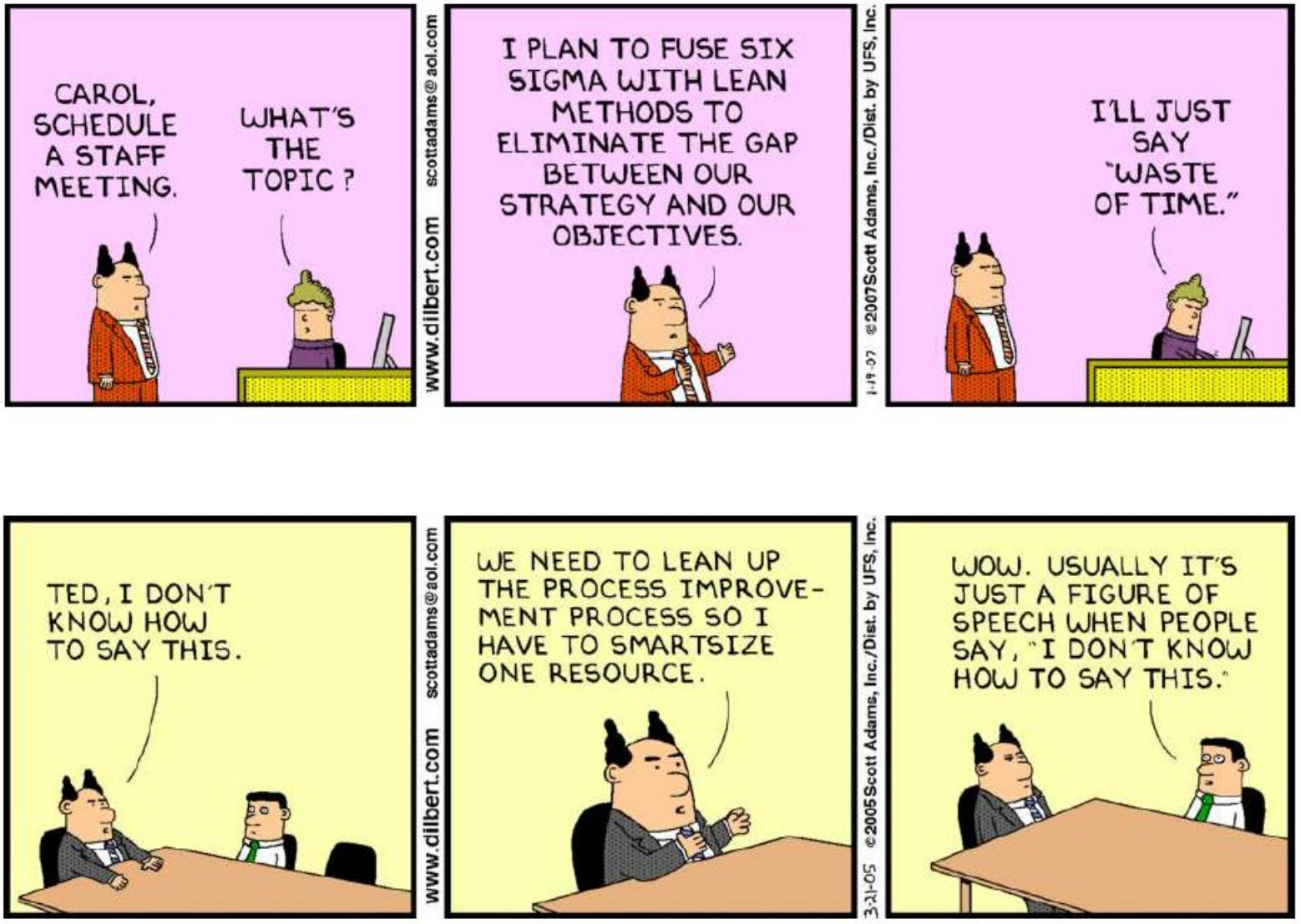
Lean Enablers grouped by Lean Principles	Concept	Develop-ment	Production	Utilization & Support	Retirement
LE 1.x: Respect the people in your program	●	●	●	●	●
LE 2.x: Capture the value defined by the key customer stakeholders	●	●	○	○	○
LE 3.x: Map the value stream and eliminate waste	●	●	○	○	○
LE 4.x: Flow the work through planned and streamlined processes	●	●	●	●	●
LE 5.x: Let customer stakeholders pull value	●	●	○	○	○
LE 6.x: Pursue perfection in all processes	●	●	●	●	●
		●: all Enablers apply		○: some Enablers do not apply	

Applicability – Project vs. Program

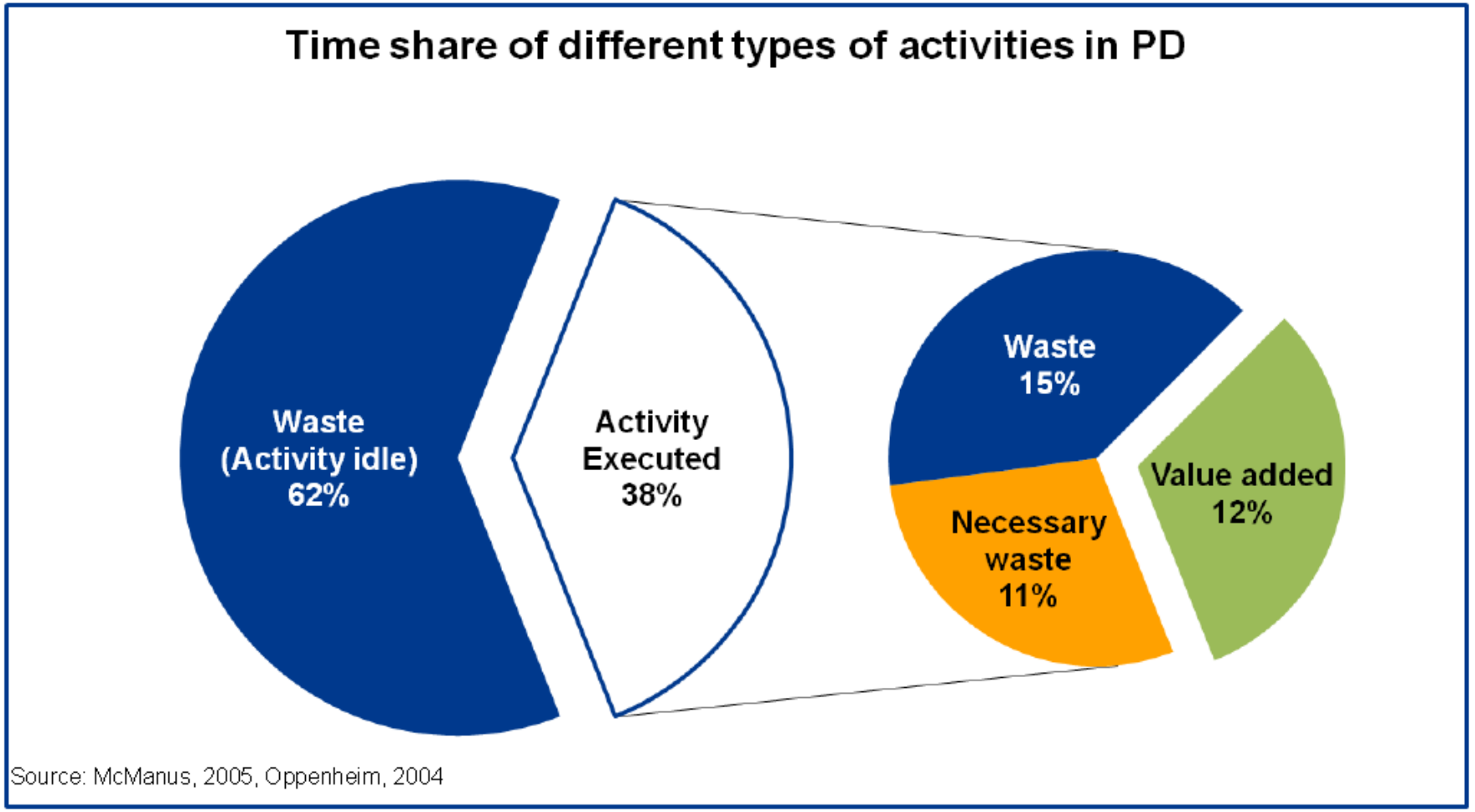
- All of the Enablers apply to your project, if your project is a program.
- If your project executes program-level activities, the corresponding Enablers apply to your program.
- The Enablers address dependencies and interfaces between projects and programs.

LEAN THINKING

Lean Management: Buzz-Word and Firing People?



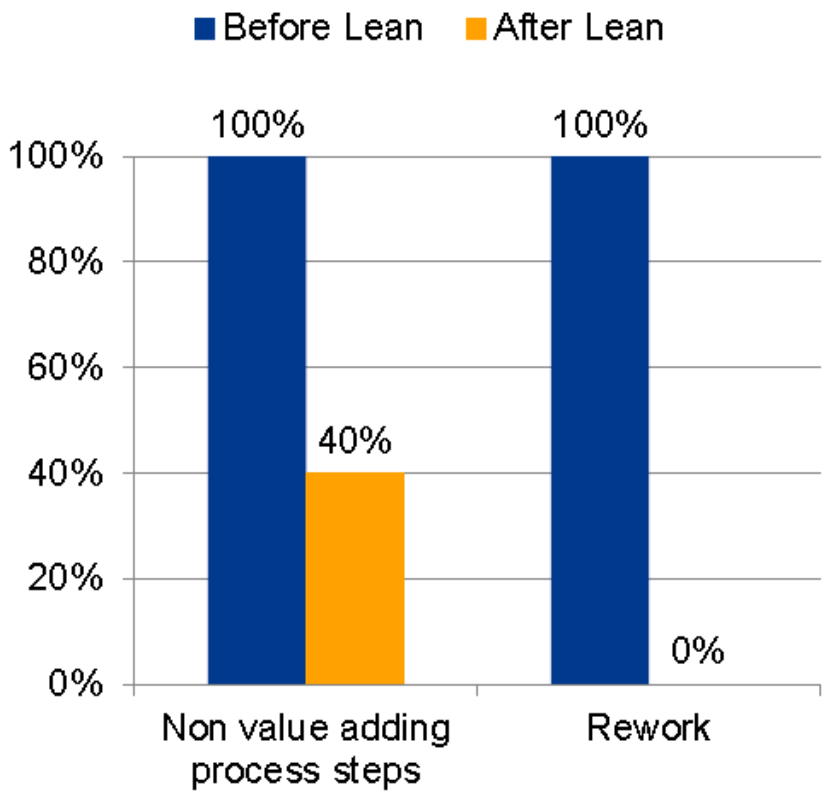
Why is Lean Product Development Important?



Lean can do that!

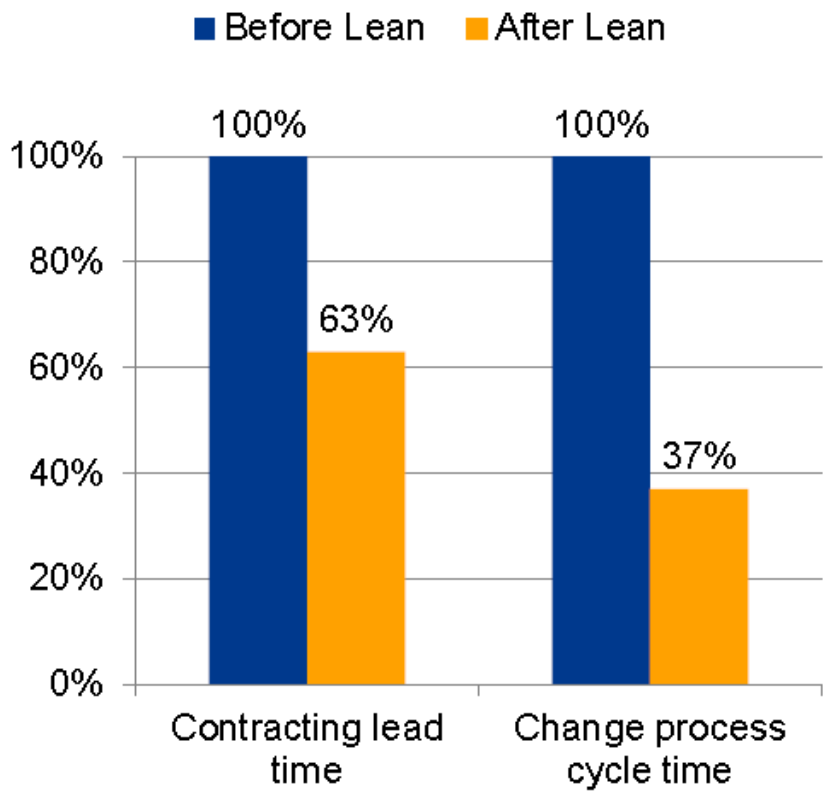
F/A-22 – Op. Flight Program

(relative figures)



Global Hawk Program

(relative figures)



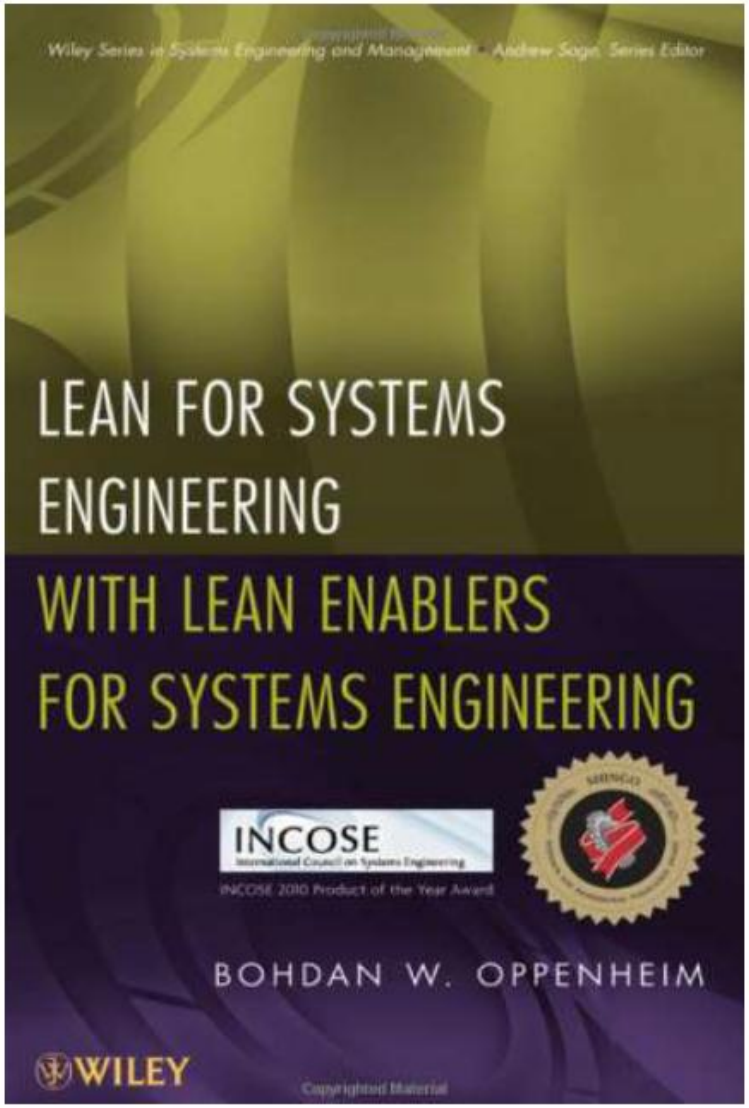
Sources: Oehmen, Rebentisch 2010: Compilation of Lean Now! Project Reports // Pictures: defenseindustrydaily.com
Additional Reading: Murman et al, Lean Enterprise Value

The Strengths of Lean: Value-Focus and Integration

Lean Thinking focusses on 6 Principles:

1. Define **value** to the program stakeholders
2. Plan the **value-adding stream** of work activities during the product lifecycle, from the need to product delivery, until disposal, while eliminating waste
3. Organize the value stream as an uninterrupted **flow** of predictable and robust tasks, proceeding without rework or backflow
4. Organize the **pull** of the work-in-progress as needed and when needed by all receiving tasks
5. Make all imperfections visible and pursue **perfection**, i.e. the process of never ending improvement
6. Base human relations on **respect** for people

Lean Enablers for Systems Engineering

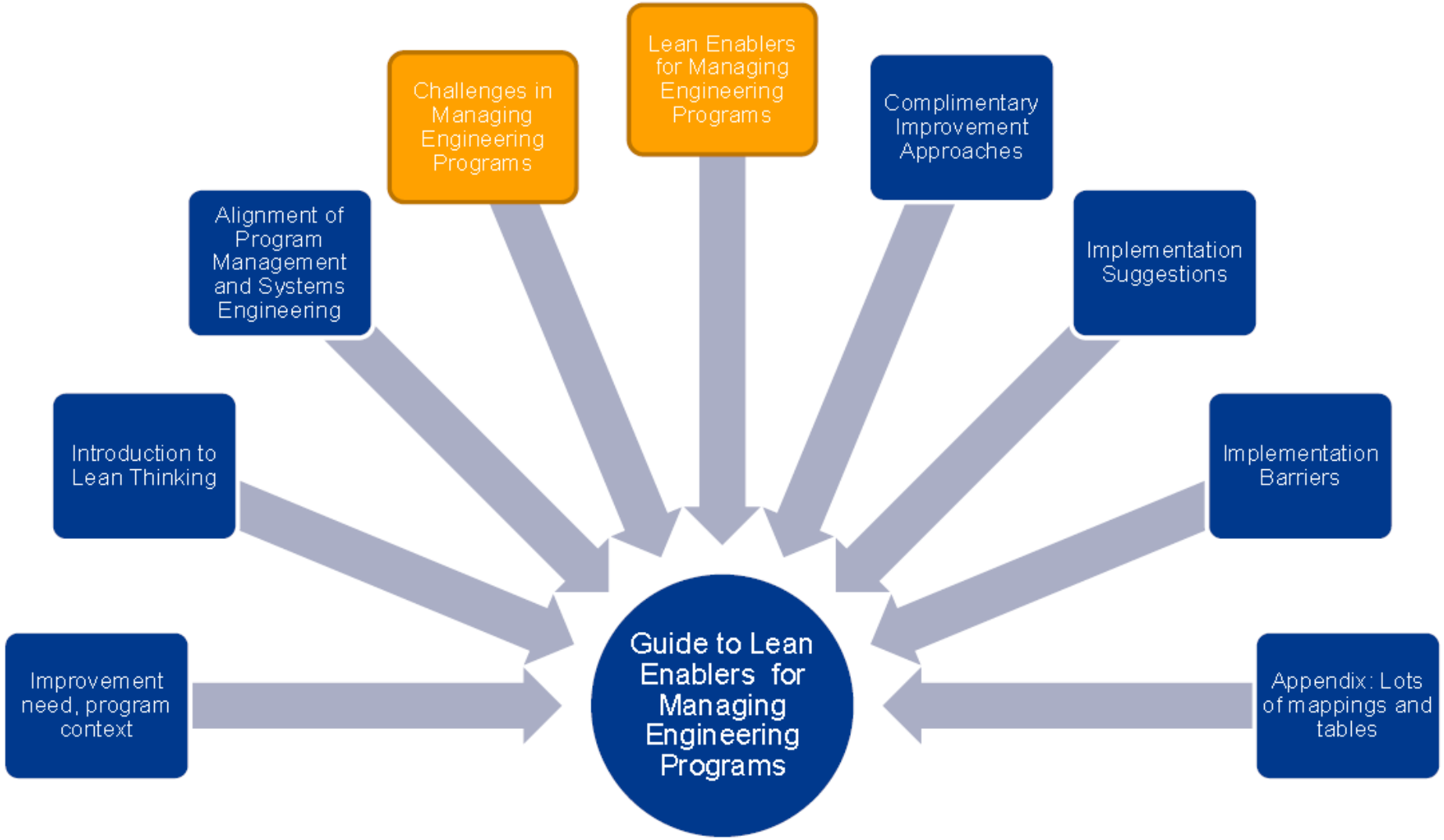


Bo Oppenheim:

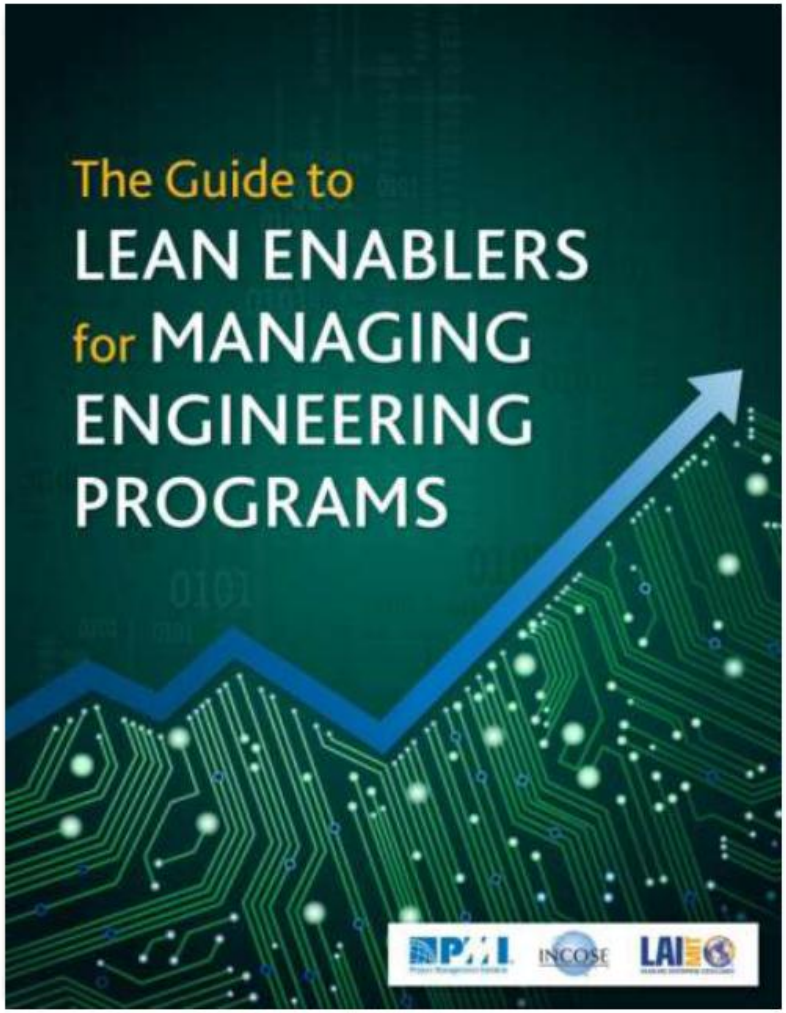
Lean for Systems Engineering with Lean Enablers for Systems Engineering, Wiley 2011

RESULTS: GUIDE TO LEAN ENABLERS FOR MANAGING ENGINEERING PROGRAMS

Year 1 Results: Baseline Recommendations



The Guide to Lean Enablers for Managing Engineering Programs



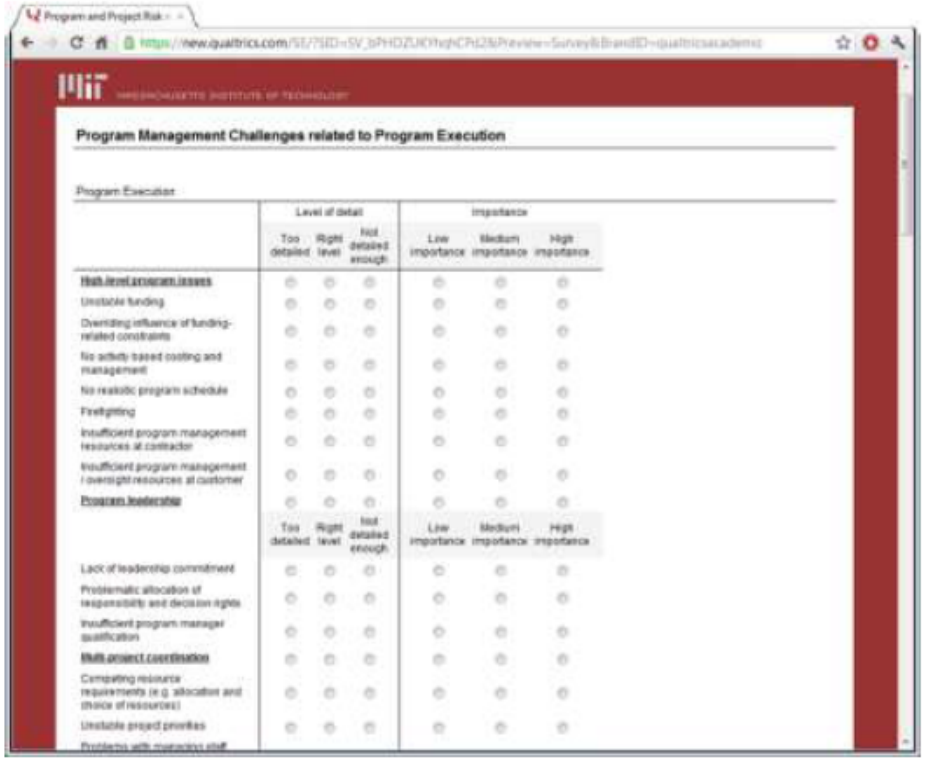
http://www.lean-program-management.org/

The Guide to Lean Enablers for Managing Engineering Programs" Receives International Recognition for Contributing to the Global Discipline of Operational Excellence

"The Guide to Lean Enablers for Managing Engineering Programs' offers careful examination of effective programs and illustrates how collaboration between program managers and systems engineers, paired with the adoption of lean enablers, contribute enormously to the success of projects," said John A. Thomas, president of INCOSE.

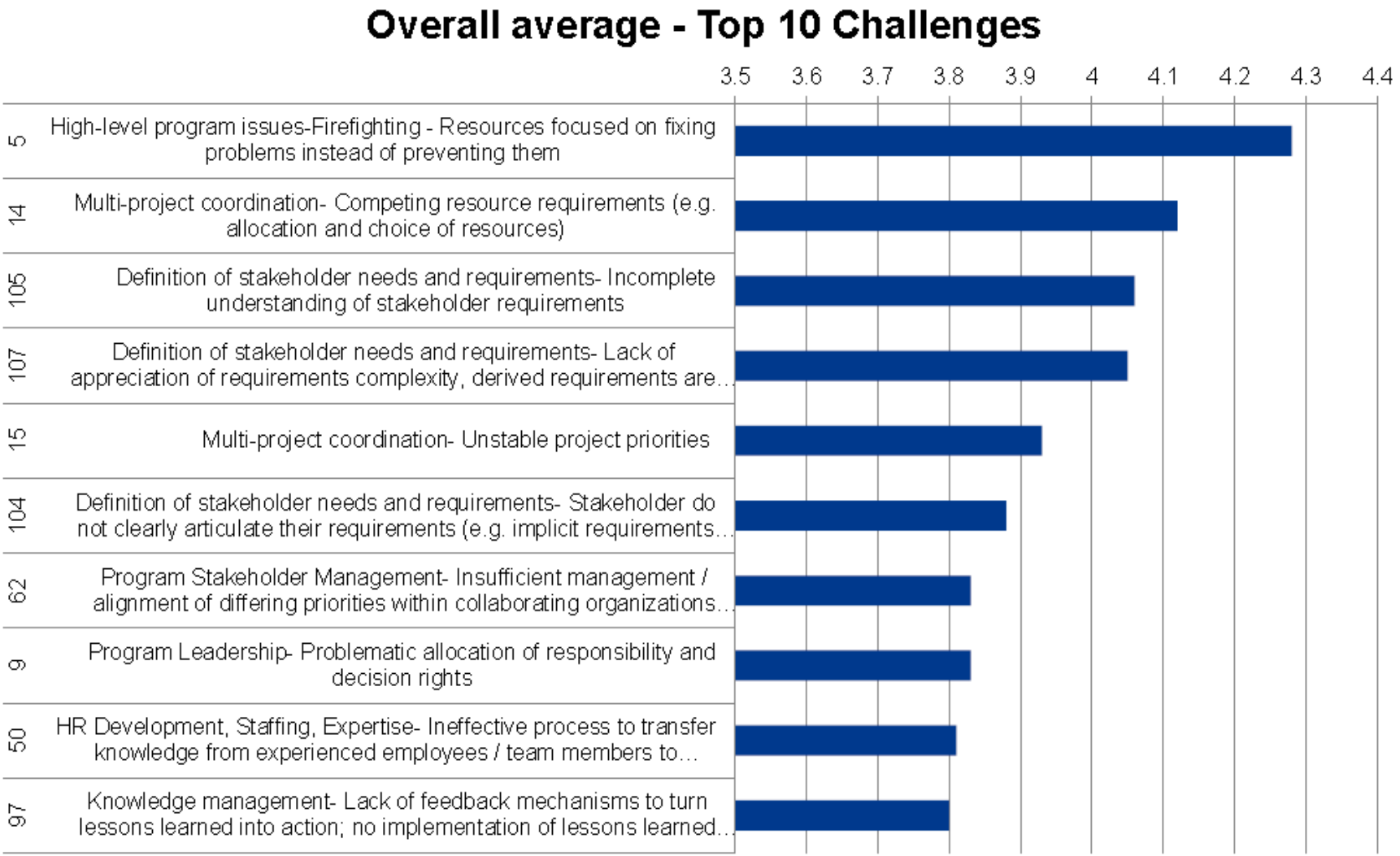
CHALLENGES IN ENGINEERING PROGRAMS

Challenges – Collection and Prioritization Process



- Literature review: 90 challenges
- Collection from subject matter experts: 210 challenges
- Consolidation: 160 challenges
- Survey: 140 participants
- Consolidation: Top 60 challenges into 10 themes

160 Challenges – Top 10



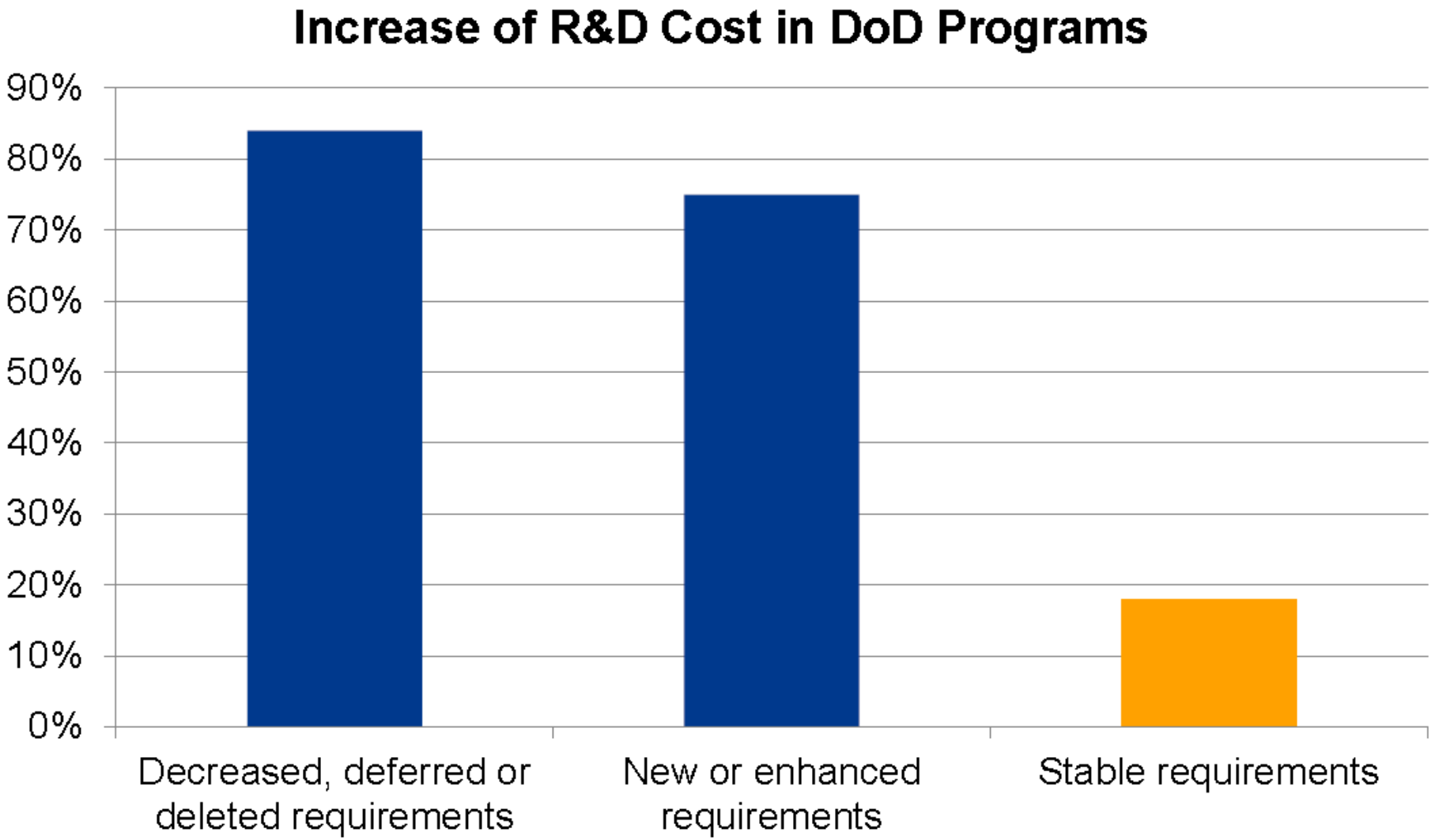
Poll 5: What is your organization's most serious engineering program challenge?

1. Reactive Program Execution
2. Lack of stability, clarity and completeness of requirements
3. Insufficient alignment and coordination of the extended enterprise
4. Value stream not optimized throughout the entire enterprise
5. Unclear roles, responsibilities and accountability
6. Mismanagement of team competency and knowledge
7. Insufficient Program Planning
8. Improper Metrics, Metric Systems and KPIs
9. Lack of Active Program Risk Management
10. Poor Program Acquisition and Contracting Practices

Prioritization and consolidation of 160+ challenges into 10 major themes

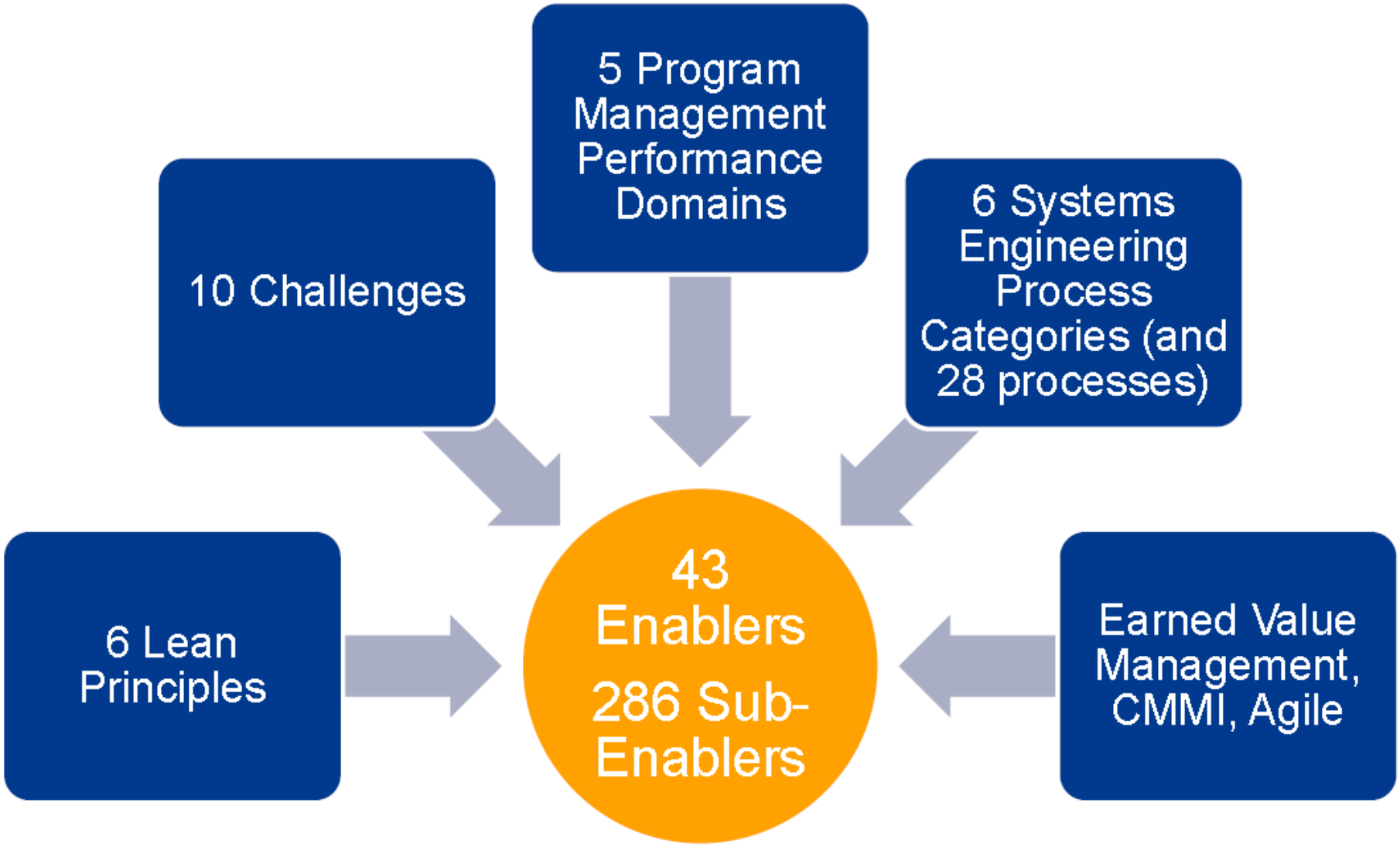
#	Theme	Definition
1	Reactive Program Execution	Program is executed in a reactive mode towards outside influences, instead of proactively managing and coordinating stakeholders, risks and issues.
2	Lack of stability, clarity and completeness of requirements	Changing, unclear and incomplete requirements from customers and other stakeholders seriously affect the efficient and effective execution of the program.
3	Insufficient alignment and coordination of the extended enterprise	The complex network of organizations and departments involved in delivering the program value is not aligned in their priorities. This includes the alignment and optimization of strategic priorities and portfolios
4	Value stream not optimized throughout the entire enterprise	The value stream is only locally optimized. There is a lack of visibility of the value stream, and / or barriers between organizational units to implement a seamless flow. There are insufficient trade-offs between organizations to reach overall optimum.
5	Unclear roles, responsibilities and accountability	The roles, responsibilities and accountability of individuals, teams, project, staff organization and organizations are not clearly defined
6	Mismanagement of team competency and knowledge	The expertise and knowledge of individuals, teams and the organization is insufficient, not transferred sufficiently, or not applied appropriately during the program.
7	Insufficient Program Planning	The program planning is inaccurate and / or unable to accommodate uncertainties, leading to unrealistic expectations and base plans.
8	Improper Metrics, Metric Systems and KPIs	The metrics and KPIs used during the program do not capture the intended performance attribute, incentivize the wrong behavior, or are lagging instead of predictive.
9	Lack of Active Program Risk Management	Budgetary and time constraints force limited or no risk management activity to be undertaken by the program team. The program team attempts to function without clear off-ramps and mitigation approaches. Ownership of risks is ill-defined.
10	Poor Program Acquisition and Contracting Practices	Time constraints force inadequate quality of the Request for Proposal (RFP) or contract bid. Improper incentives, improper management of low-TRL-technologies, insufficient leadership and interference of laws and regulations all exacerbate this challenge.

Challenge 2: Requirements stability and cost

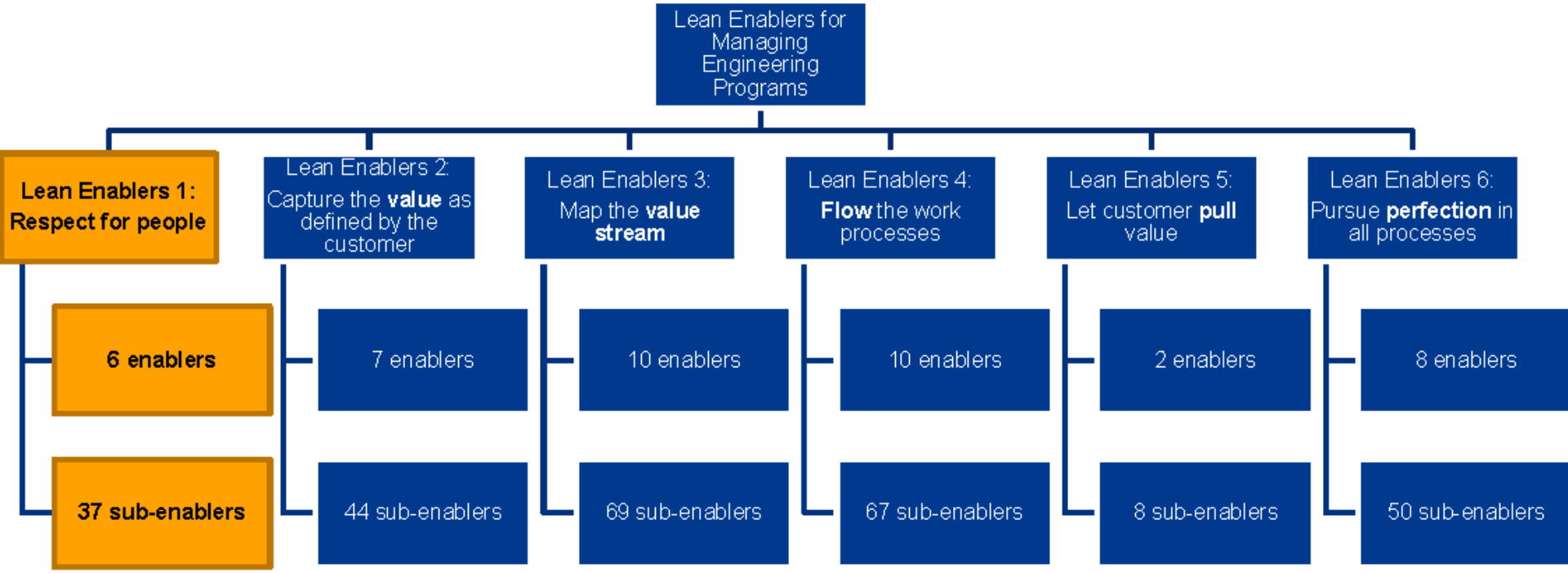


OVERVIEW OF LEAN ENABLERS

Finding the Enabler that is right for you: Various mappings



Lean Enablers: 300 Best Practices in 40 Categories



Lean Enablers 1.x : Treat People as Your Most Important Asset (Lean Principle 6)
6 Enablers, 43 Sub-Enablers

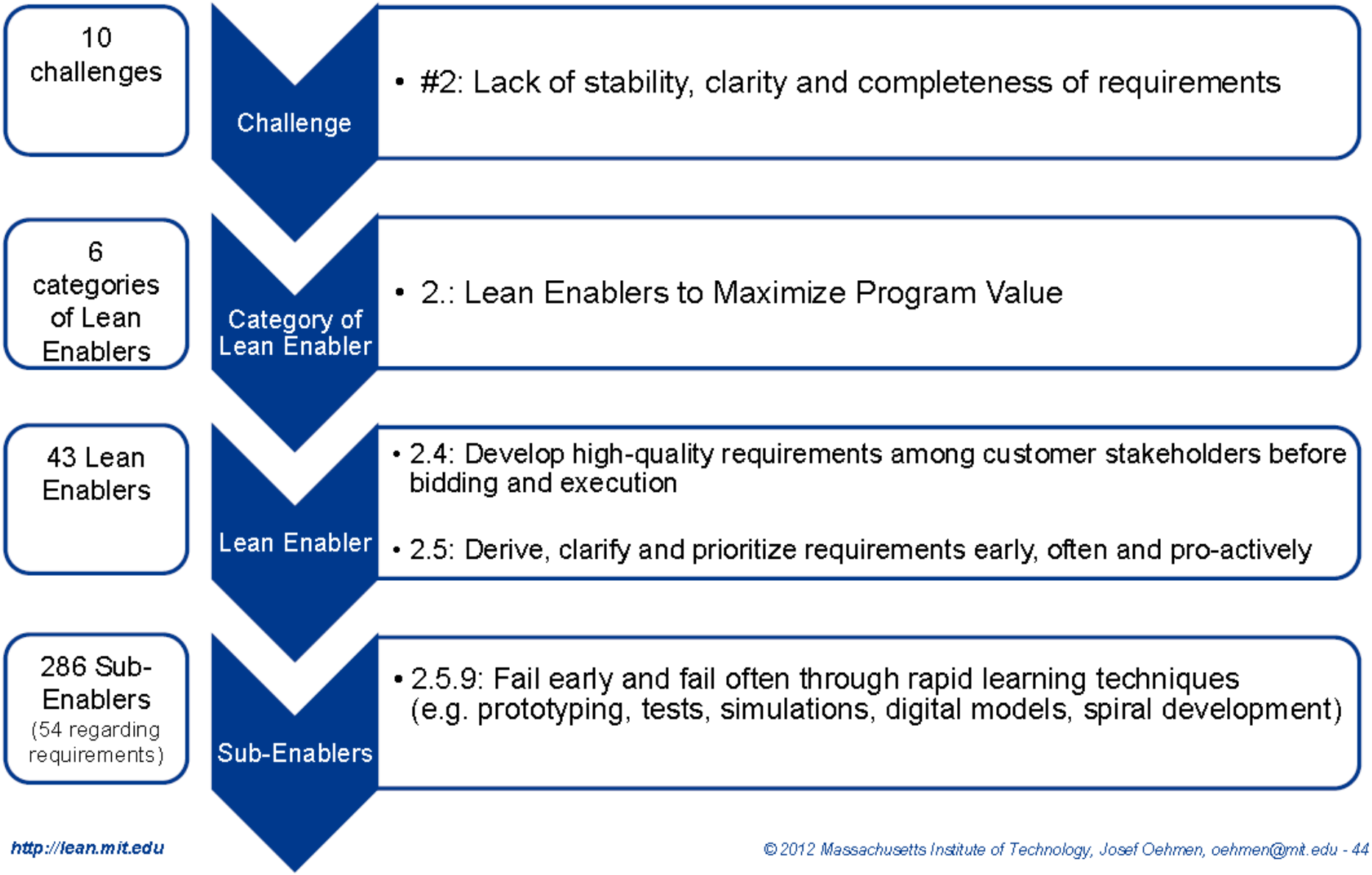
1. Build a program culture based on respect for people

2. Motivate by making the higher purpose of the program and program elements transparent
3. Support an autonomous working style
4. Expect and support people in their strive for professional excellence and promote their careers

5. Promote the ability to rapidly learn and continuously improve
6. Encourage personal networks and interactions

Watch Dan Pink at:
http://www.youtube.com/watch?v=u6XAPnuFjJc

Example of Lean Enablers Addressing Requirements Stability



Example Enablers addressing stability, clarity and completeness of requirements (1)

- Understanding what customer wants: **2.1 Establish value of the program to the stakeholders**
  - 2.1.1. Define value as the outcome of an activity that satisfies at least three conditions. a. The external customer stakeholders are willing to pay for value. b. Transforms information or material or reduces uncertainty. c. Provides specified program benefits right the first time.
  - 2.1.2. Define value - added in terms of value to the customer stakeholders and their needs
  - 2.1.3. Develop a robust process to capture, develop, and disseminate customer stakeholder value with extreme clarity.
  - 2.1.4. Proactively resolve potential conflicting stakeholder values and expectations, and seek consensus.
  - 2.1.5. Explain customer stakeholder culture to Program employees, i.e. the value system, approach, attitude, expectations, and issues.

Major Themes of the Lean Enablers

- Respect for people
- Focus on value and benefits
- Frequent engagement of all stakeholders. Direct and efficient communication.
- Clear responsibility, authority and accountability
- High-quality requirements up-front and effective management of requirement change
- Front-loading of program planning
- Organize program around value and benefits, not departments and companies
- Use of effective metrics: Leading indicators, transparency regarding status on all levels, clear line-of-sight to strategic goals
- Continuous improvement, inclusive towards all best practices

LEAN ENABLERS FOR PROGRAM SUCCESS

Content analysis: PMI Project (Program) of the Year Winners of the last 10 years







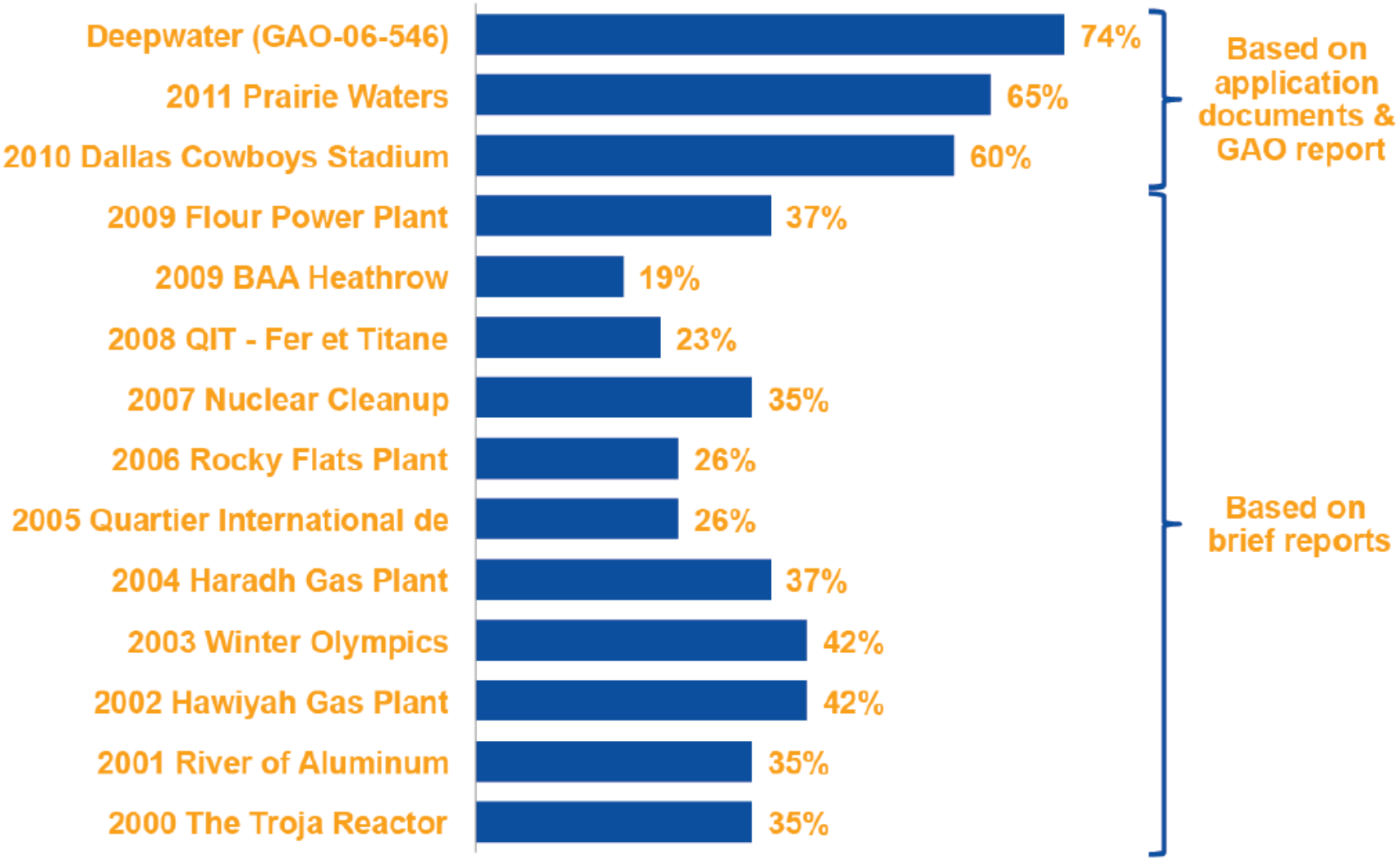



PMI Project Management Institute

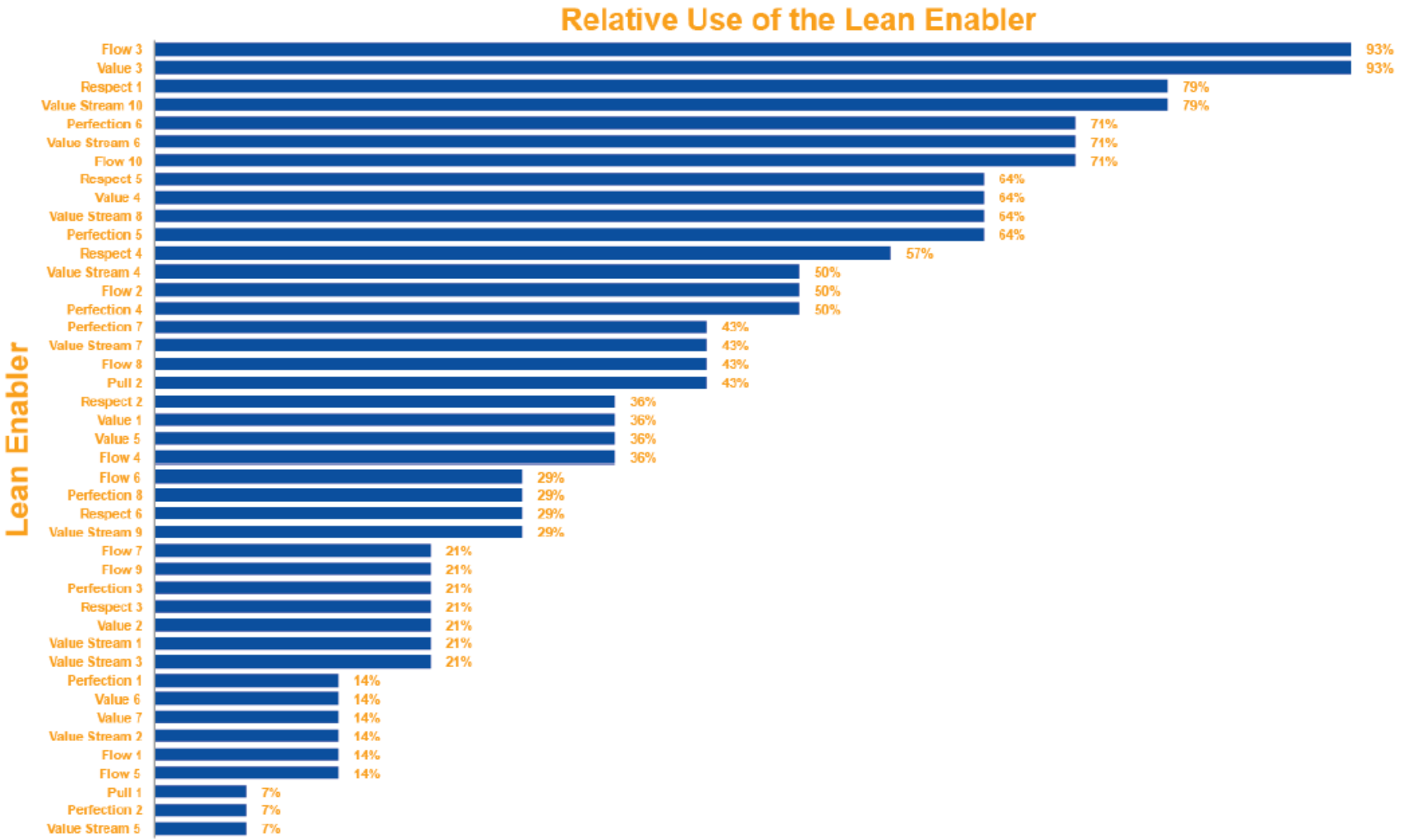
UNITED STATES GOVERNMENT ACCOUNTABILITY OFFICE

UNITED STATES COAST GUARD

Application of Lean Enablers in "Best Practice Programs"– The more detailed the reports, the more Enablers we found



Every Lean Enabler was used at least once



Most popular vs rarely used enablers

Almost always found

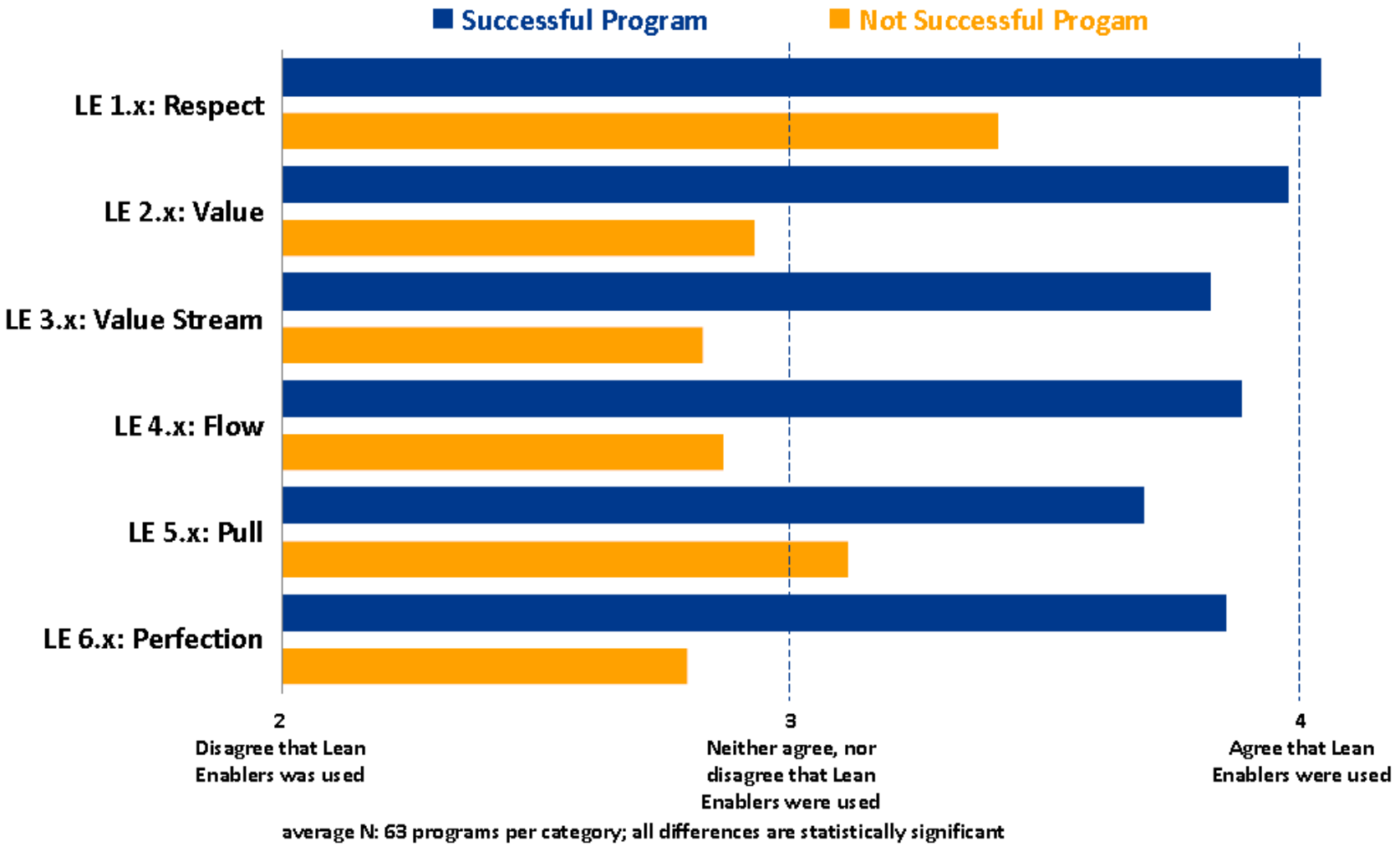
- **Build a program culture based on respect for people**
- For every program, use a program manager role to lead and integrate program from start to finish
- Frequently engage the stakeholders throughout the program lifecycle
- Develop a Communications Plan

Rarely found

- Pull tasks and outputs based on need, and reject others as waste
- Pursue Lean for the long term
- Use probabilistic estimates in program planning

Lean Enabler for Managing Engineering Programs
Lean Principles

Use of Lean Enablers in Successful and Unsuccessful Programs:
Level of Agreement of Respondents



average N: 63 programs per category; all differences are statistically significant

IMPLEMENTING THE LEAN ENABLERS: THE ROAD AHEAD

Implementing Lean Enablers: What we have

- Mapping to challenges, program management performance domains, systems engineering processes, lean principles
- Brief examples on the “enabler” level
- High-level discussion of using Lean Enablers in change management process

Implementing Lean Enablers: The Road Ahead

- System of metrics to track implementation and performance contribution of Lean Enablers. The metrics walk the fine line between being overly burdensome in their collection and analysis versus being to coarse to provide specific incentives and decision support.
- Extended documentation for each enabler, including a more description, implementation suggestions, examples, metrics, and references to background material.
- Training courses and teaching material
- Providing a forum for the exchange of implementation experiences, both successes and challenges.

- For more information on the Lean Enablers contact David Meza at david.meza-1@nasa.gov
- Join us on www.lean-program-management.org and sign up for our monthly update
- Join us as a Subject Matter Experts: Contact Josef at oehmen@mit.edu
- Sponsor a research project for a pilot implementation at you organization