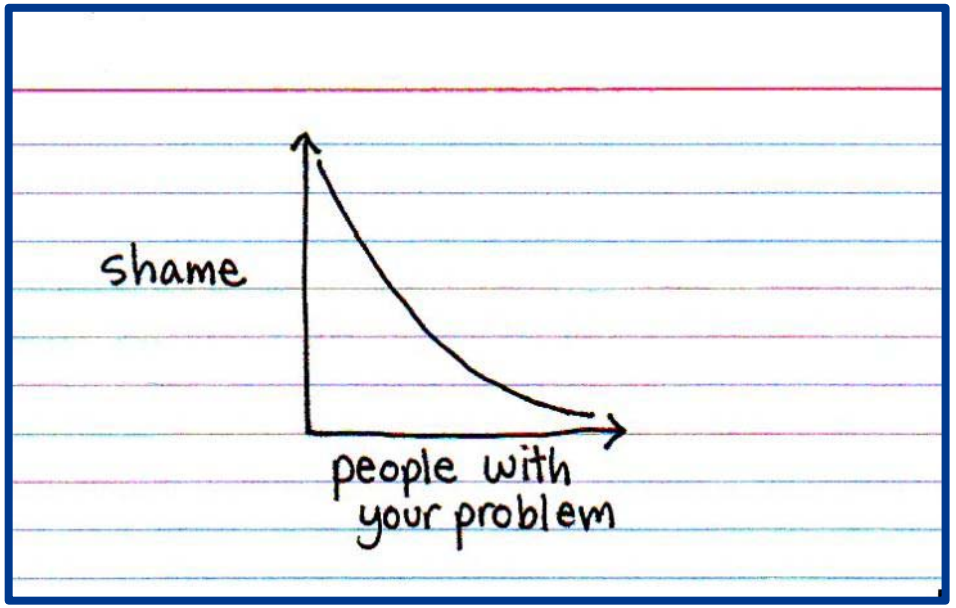
Lean Enablers for Managing Engineering Programs

Presentation to the INCOSE Enchantment Chapter – June 13 2012

Josef Oehmen

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.



LAI MIT
ENABLING ENTERPRISE EXCELLENCE

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

Pratt & Whitney
A United Technologies Company

BAE SYSTEMS

parc
Palo Alto Research Center

Raytheon

Rockwell Collins

SIEMENS

PRICEWATERHOUSECOOPERS

THE AEROSPACE CORPORATION

ULA
United Launch Alliance

Booz | Allen | Hamilton

NORTHROP GRUMMAN

syncroness
innovative product development

Google

CORNING

Abbott
A Promise for Life

LMU|LA
Loyola Marymount University

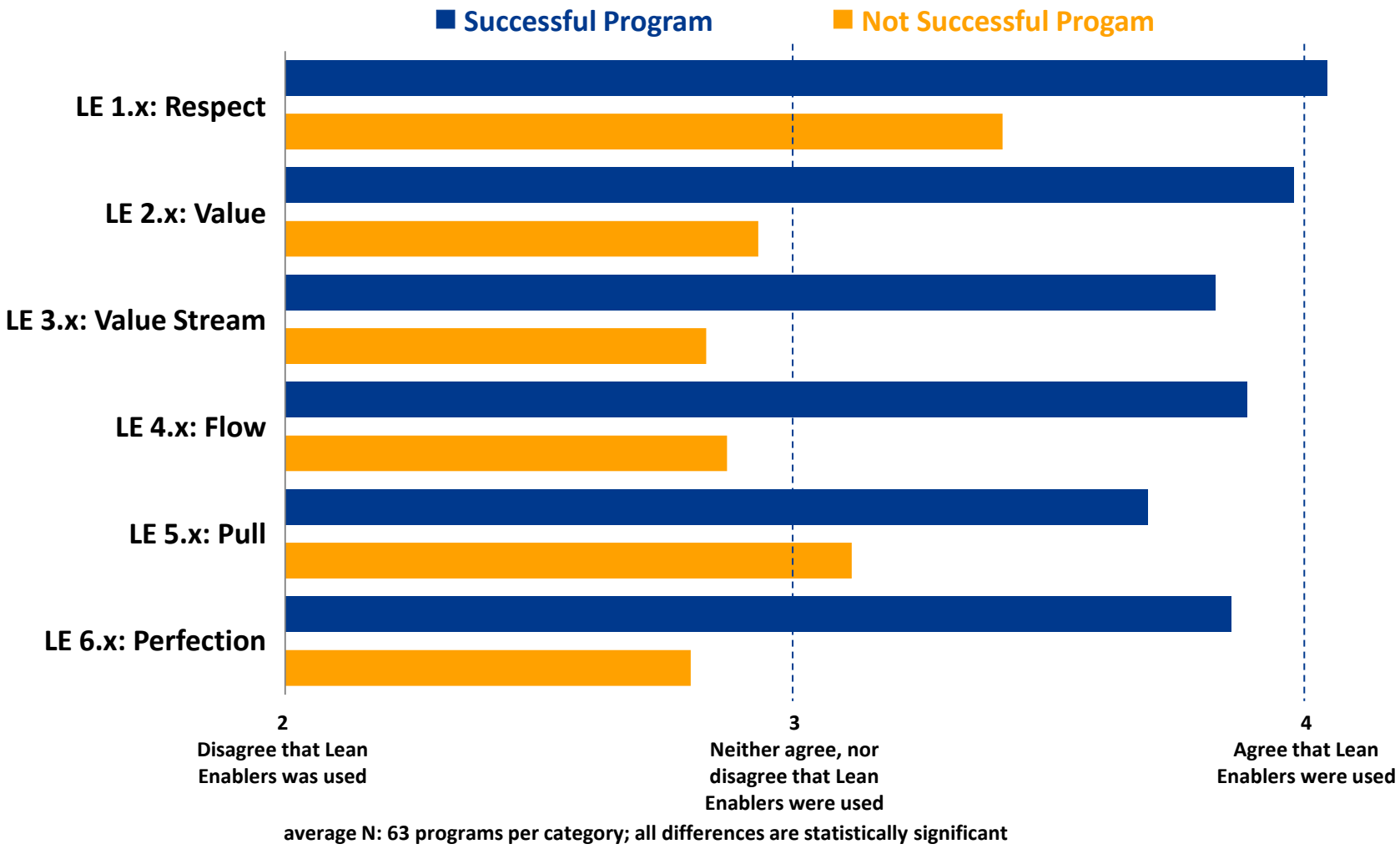
Massachusetts Institute of Technology

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** (180+ 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

Lean Enabler for Managing Engineering Programs
Lean Principles

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



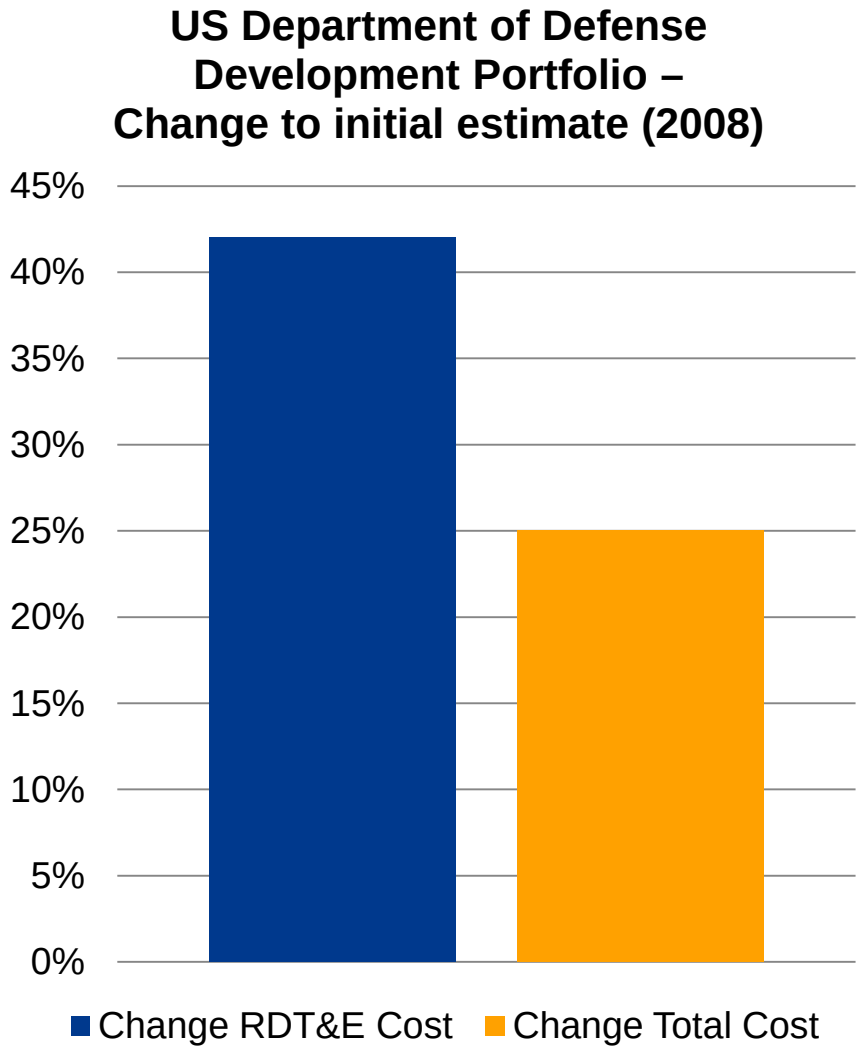
average N: 63 programs per category; all differences are statistically significant

MOTIVATION

How are we doing in the management of large-scale engineering programs?

- Regarding cost?
- Regarding schedule?
- Regarding delivering the benefits we promised?

Management of Large-Scale Engineering Programs: DOD Example



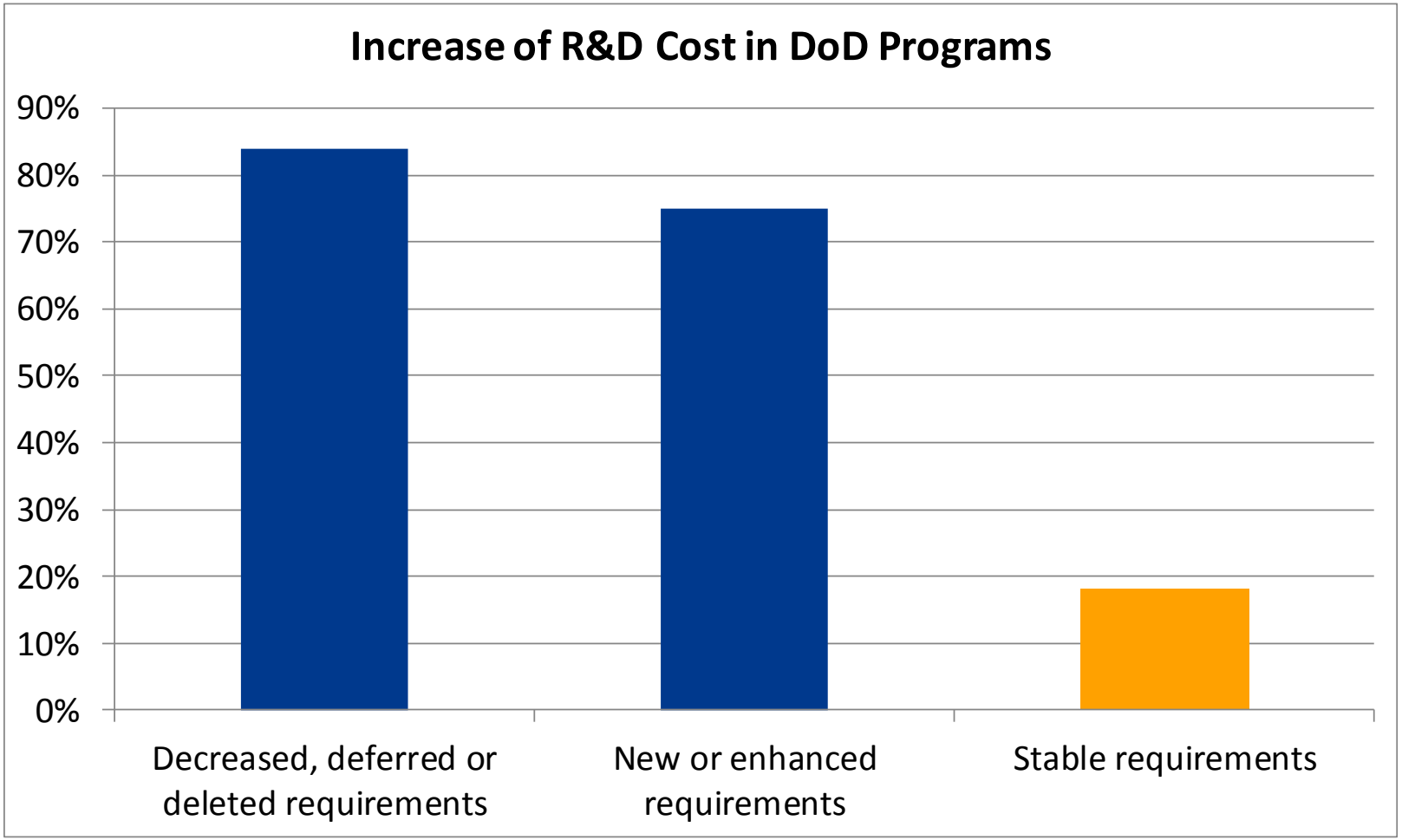
- Total cost growth: **$296 billion**
- Average schedule overrun: **22 months**
- Similar situation in other industries

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

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

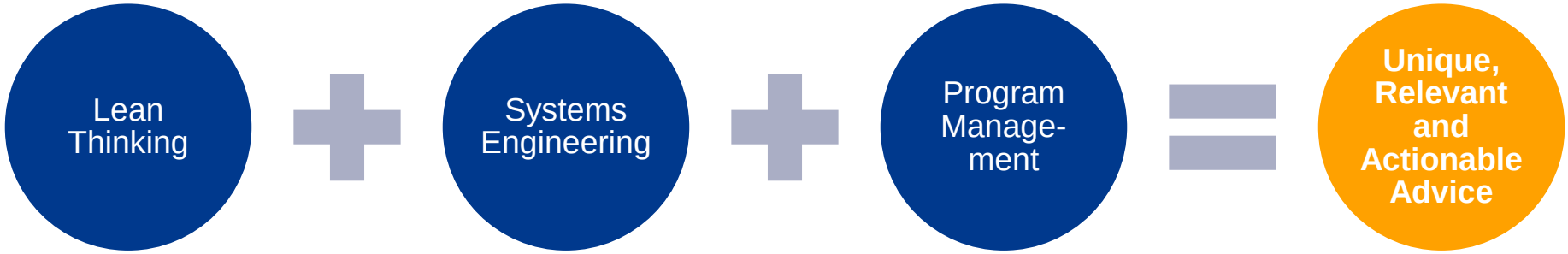
How bad are unstable requirements?



Source: GAO-11-233SP

INNOVATION BY BRIDGING KNOWLEDGE DOMAINS

Study Design: Innovation by Bridging Knowledge Domains



Unique

- Three world-class organizations and thought leaders joined forces
- Industry, government and academia participation

Relevant

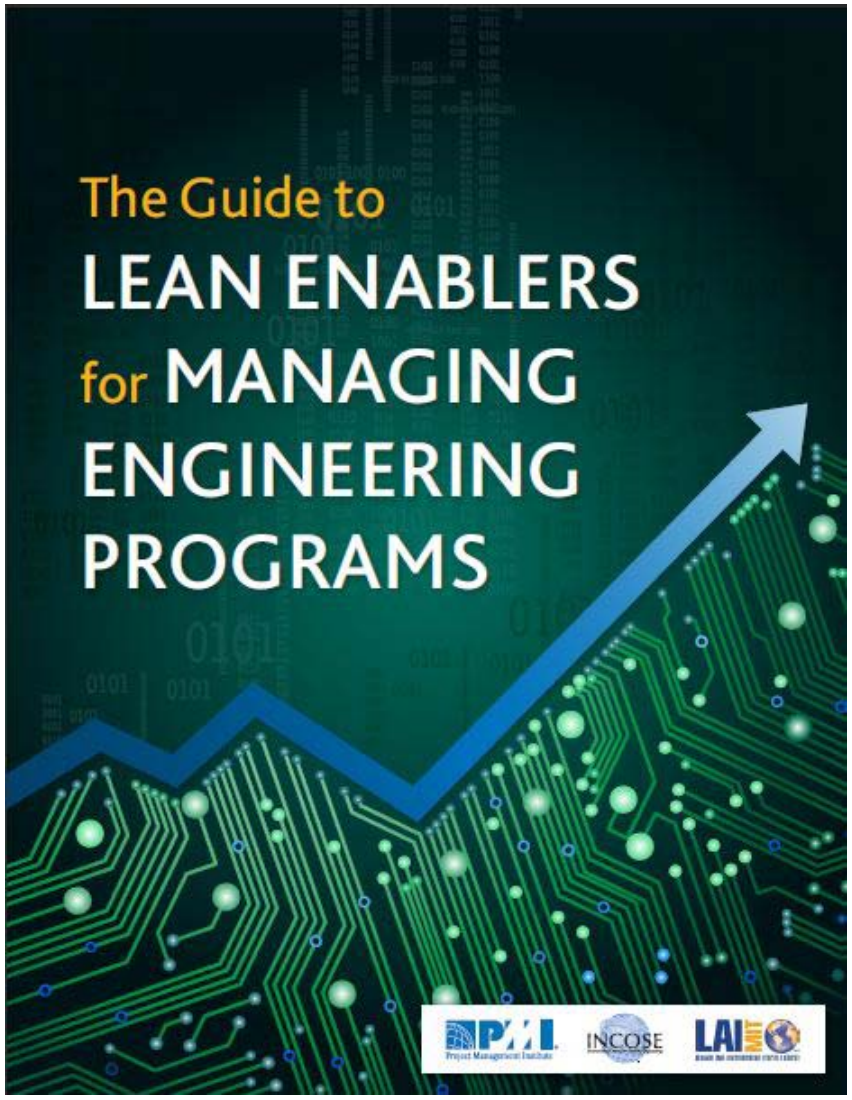
- Massive challenges in program execution: Cost and schedule overruns
- Integration of knowledge and professional domains
- Extensively validated

Actionable

- Concrete advice
- Mapped to known challenges and existing standards
- Guidance for implementation

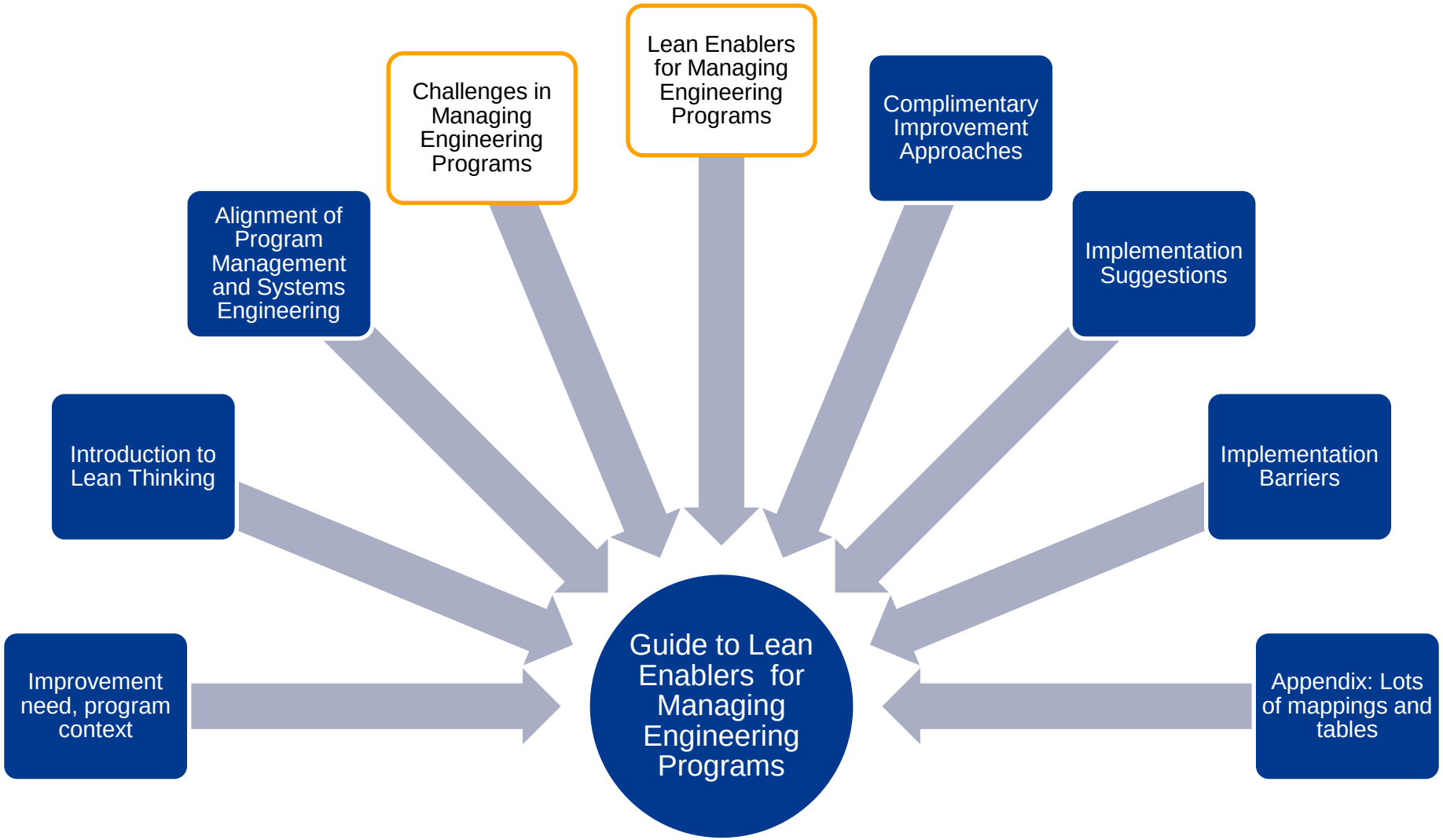
THE GUIDE TO LEAN ENABLERS FOR MANAGING ENGINEERING PROGRAMS

Download at http://hdl.handle.net/1721.1/70495
Read the Press Releases from LAI, PMI, and INCOSE

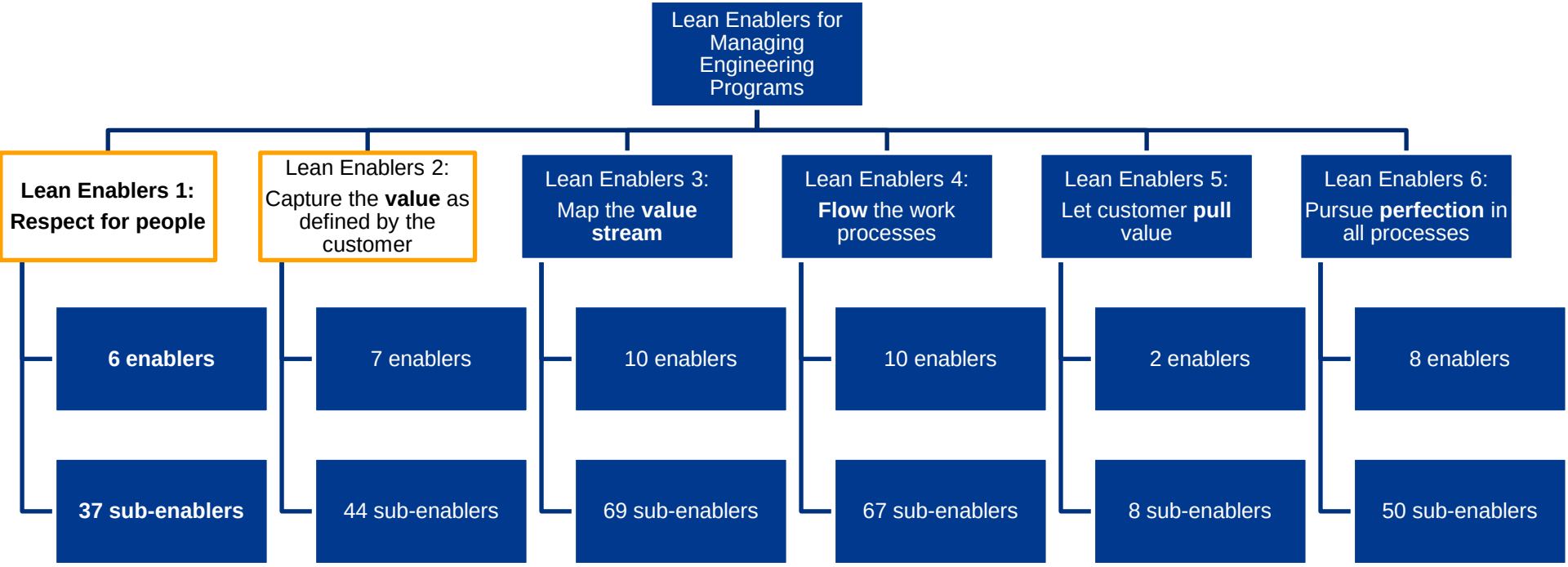


- Section 1: Introduction
  - Document overview
  - Motivation and impact
  - Applicability and scope
- Section 2: Overview Lean Thinking
  - Value and waste
  - Six lean principles
- Section 3: Integration of Program Management and SE
  - Relationship program management and SE
  - Introduction to program management and SE
  - Stakeholders and value
- Section 4: Top 10 Challenges
- Section 5: Lean Enablers
  - List of Enablers
  - Mapping to program management, challenges and SE
- Section 6: Complementary improvement approaches
  - Agile, CMMI, and EVM
- Section 7: Implementation recommendations
- Section 8: Barriers to implementation
- Appendix
  - Complementary information sources
  - References
  - Detailed mapping‘

Baseline Recommendations



Lean Enablers: 300 Best Practices in 40 Categories



EXAMPLES

Programs fail or succeed primarily based on people, not processes or tools

- What is the key to motivating knowledge workers? Money! Really?

Source: danpink.com

Watch Dan Pink at

http://www.youtube.com/watch?v=u6XAPnuFjJc

(or Google "Dan Pink RSA")

Example 1: Treat People as Your Most Important Asset (LE 1.x.x)

1.1.x Build a program culture based on respect for people

1.2.x Motivate by making the higher purpose of the program and program elements transparent

1.3.x Support an autonomous working style

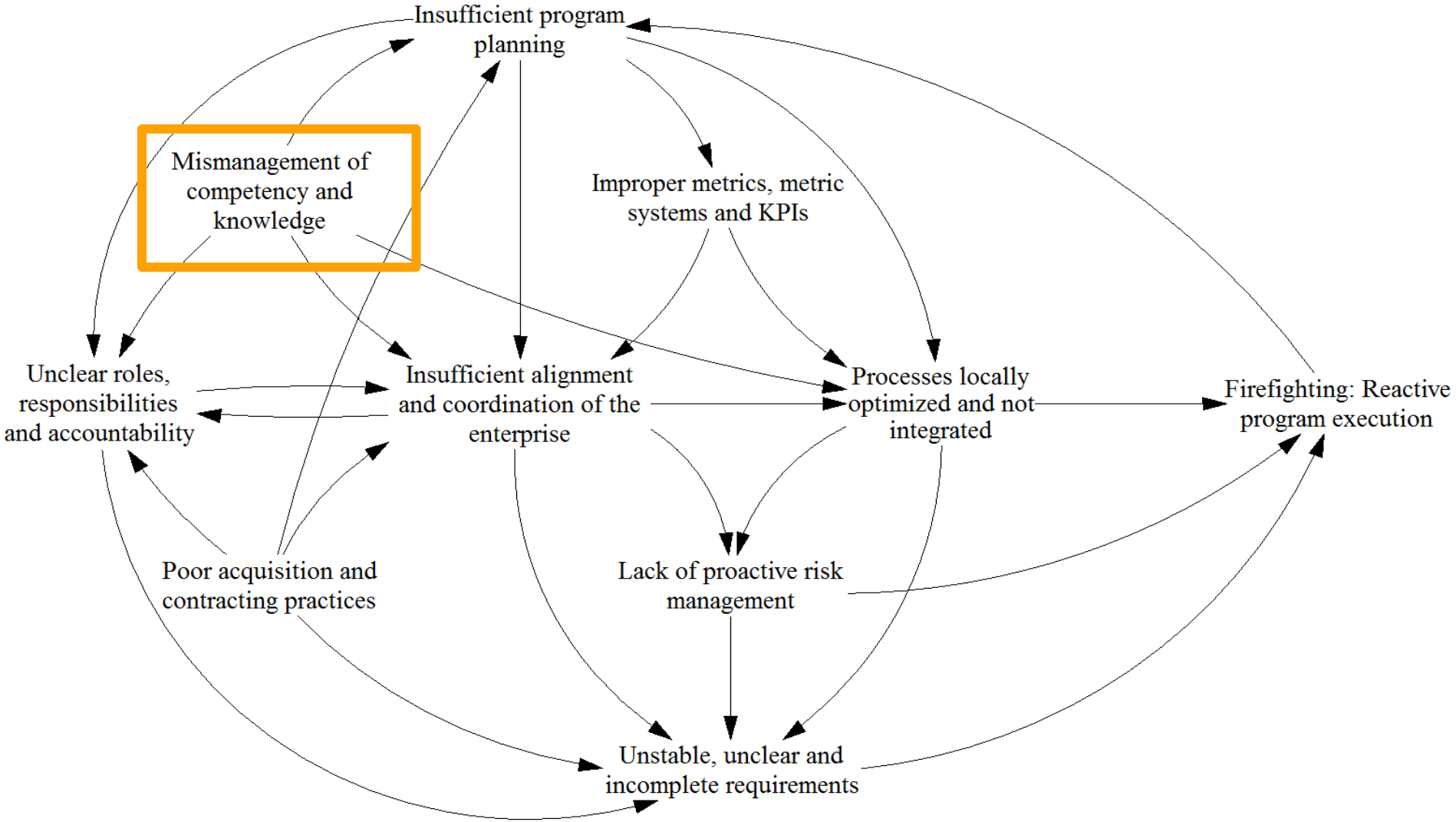
1.4.x Expect and support people in their strive for professional excellence and promote their careers

Source: danpink.com

1.5.x Promote the ability to rapidly learn and continuously improve

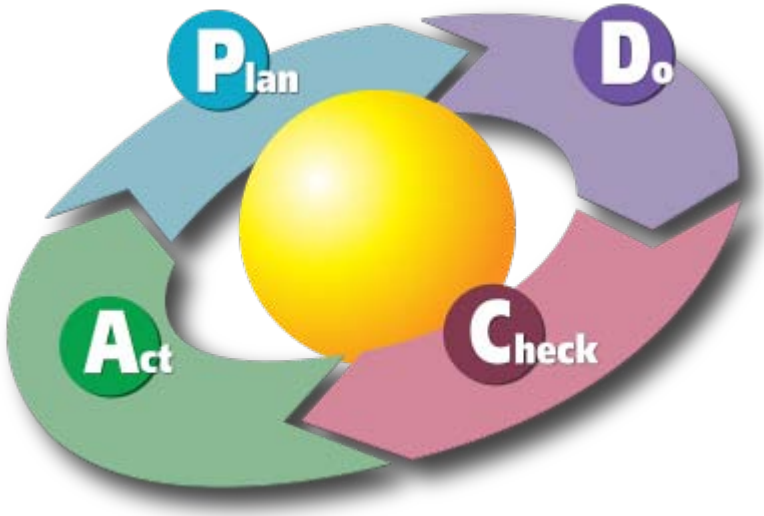
1.6.x Encourage personal networks and interactions

What challenges do you address by helping people to become highly capable and motivated?



Associated Lean Methods and Tools

- Mastery:
  - Create Specialist Career Path to develop towering (technical) competence
  - Communities of Practice (internal and external)
  - Mentoring
  - Hire for attitude, train for skill
- Autonomy:
  - Kaizen: Bottom-up continuous improvement processes
  - Responsibility-based planning and control
- Purpose:
  - Create a shared vision that draws out the best in people (e.g. through value stream mapping)

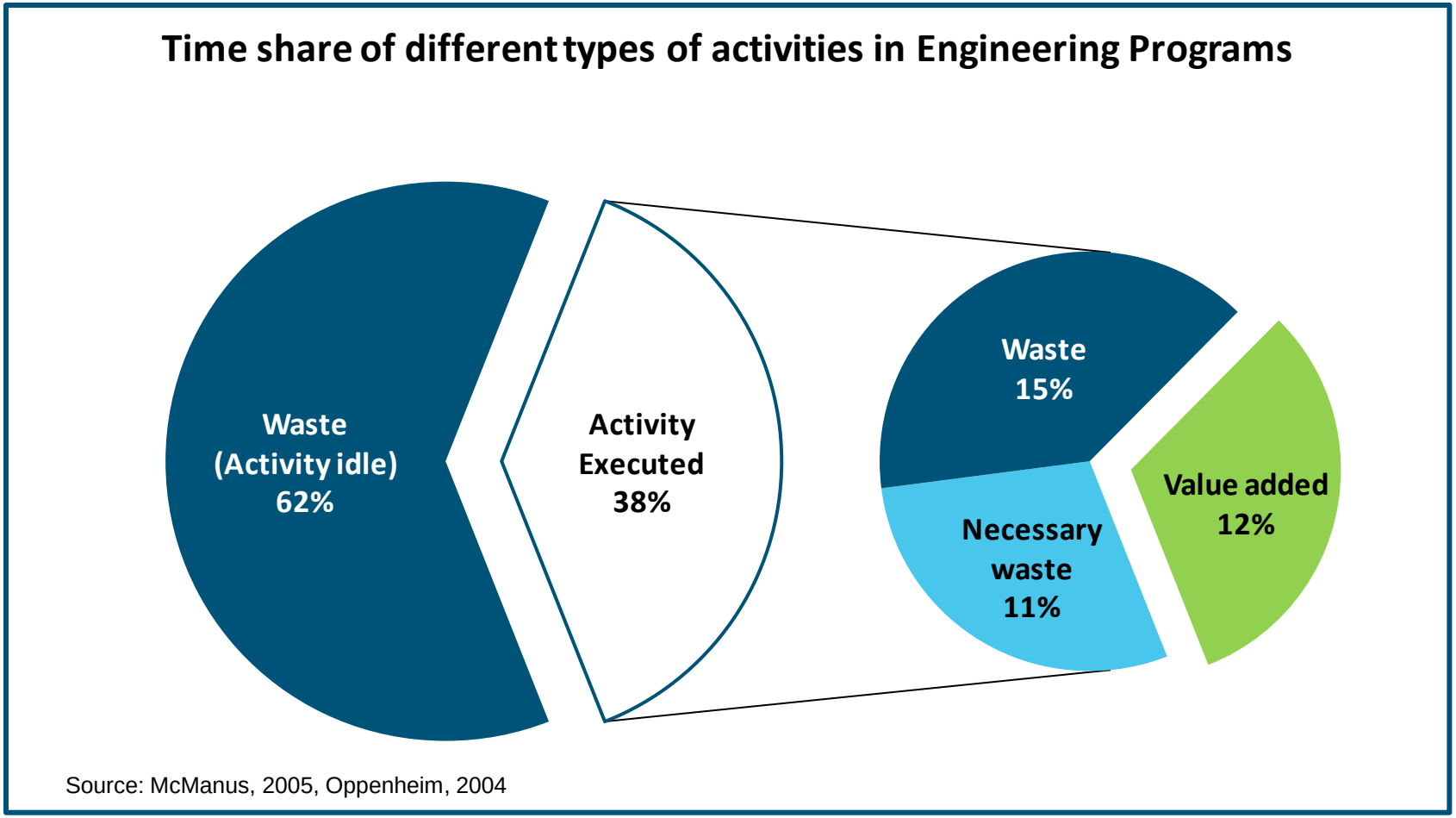


Source: Wikipedia

Example 2: Optimize the value stream (LE 3.x.x) and create flow (LE 4.x.x)

- Use formal value stream mapping methods to identify and eliminate management and engineering waste, and to tailor and scale tasks. (LE 3.1.4)
- Use Lean tools to promote the flow of information and minimize handoffs. Implement small batch sizes of information, low information in inventory, low number of concurrent tasks per employee, small takt times, wide-communication bandwidth, standardization, work cells, and training. (LE 4.1.19)

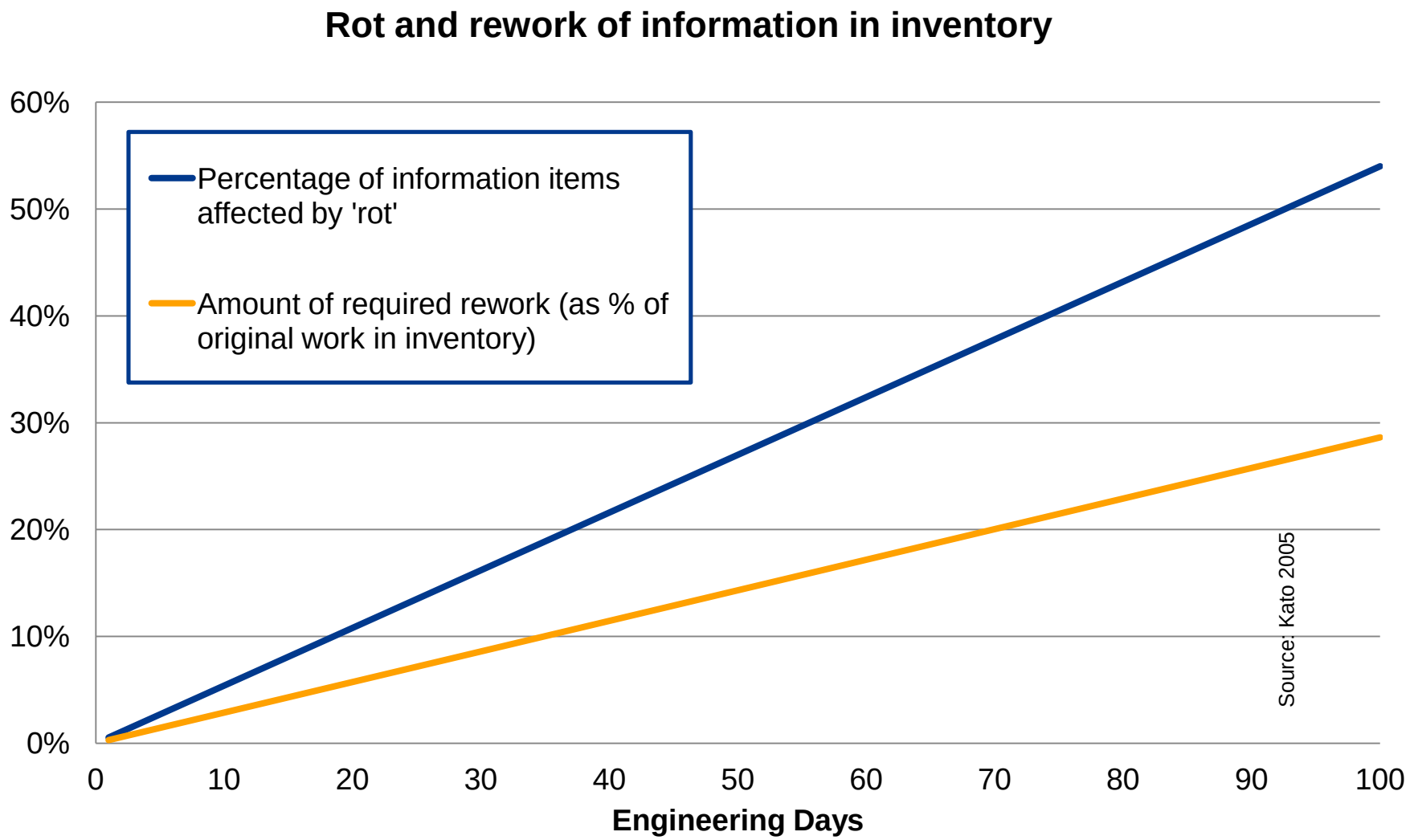
Addresses challenge of value stream not being optimized throughout the entire enterprise



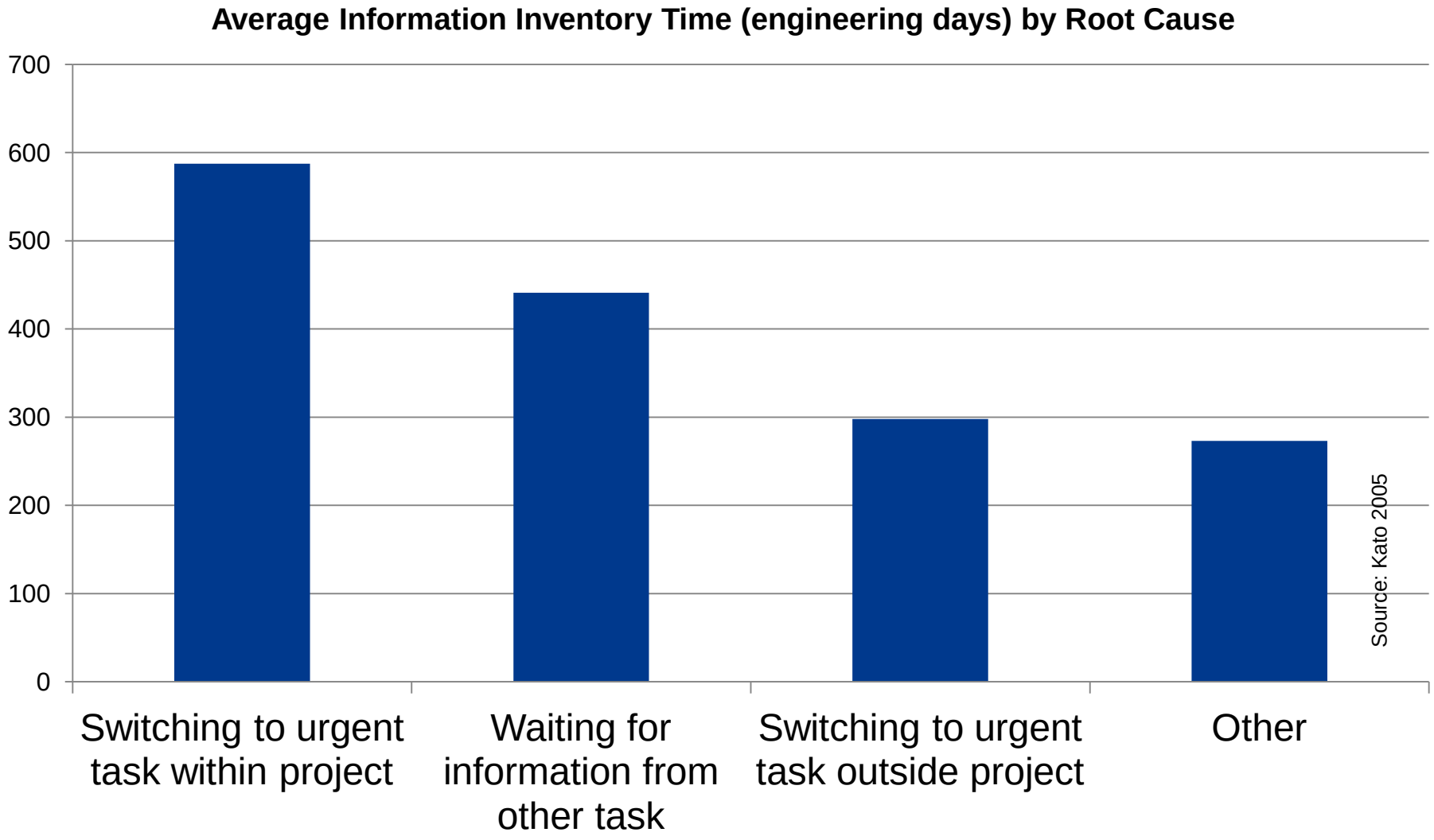
Waste in Engineering Programs - Examples

Seven Wastes	Engineering Program Examples
Waiting	• **Waiting for information or decisions** • **Information or decisions waiting for people to act** • Large queues throughout the review cycle • Long approval sequences • Unnecessary serial effort
Over-Processing of Information	• **Refinements beyond what is needed** • **Point design used too early, causing massive iterations** • Uncontrolled iterations (too many tasks iterated, excessive complexity) • Lack of standardization • Data conversions
Inventory of Information	• **Keeping more information than needed** • **Excessive time intervals between reviews** • Poor configuration management and complicated retrieval • Poor 5 S's (sorting, straightening, systematic cleaning, standardizing, and sustaining) in office or databases
Rework, Defects	• **The killer "re's": Rework, Rewrite, Redo, Re-program, Retest...** • **Unstable requirements** • Uncoordinated complex task taking so much time to execute that it is obsolete when finished and has to be redone • Incomplete, ambiguous, or inaccurate information • Inspection to catch defects
...	

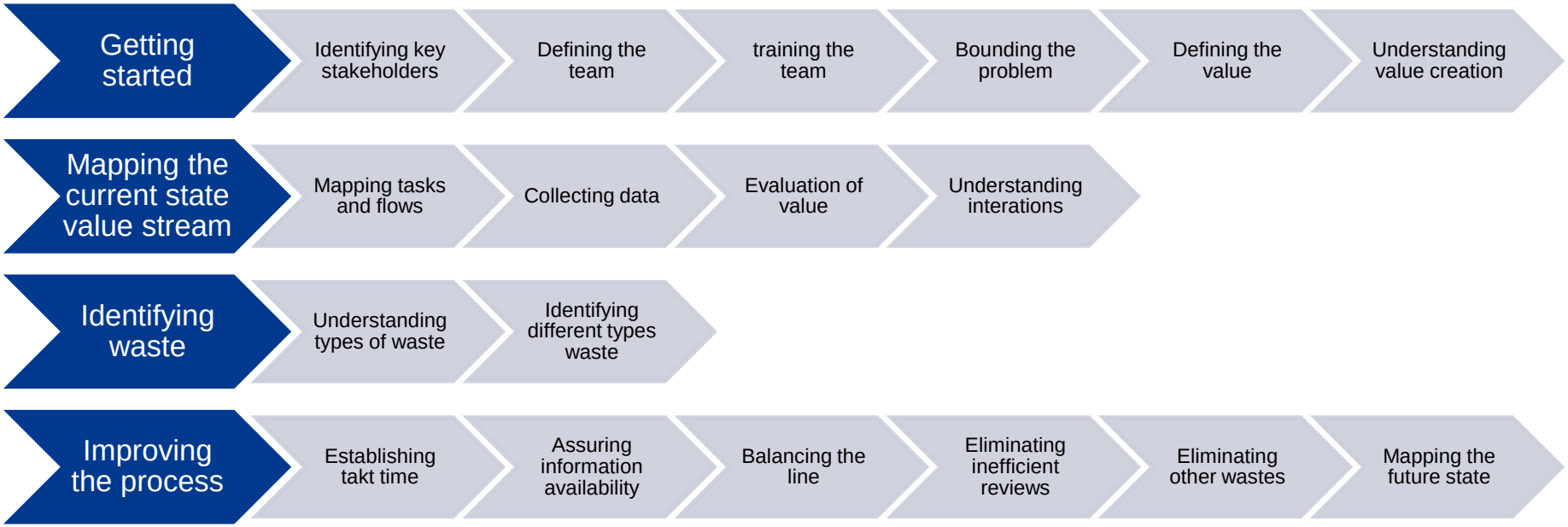
Why “Flow” is key: Information rots!



How information inventory is created: Task switching

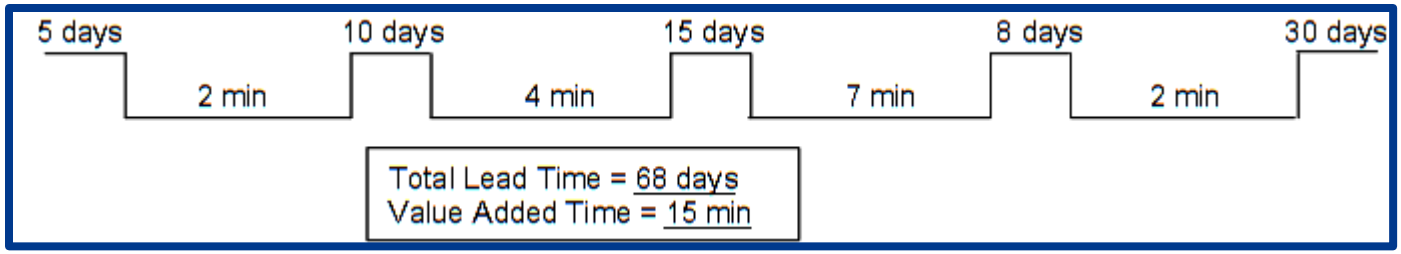


Engineering Value Stream Mapping Process



Source: McManus, 2005

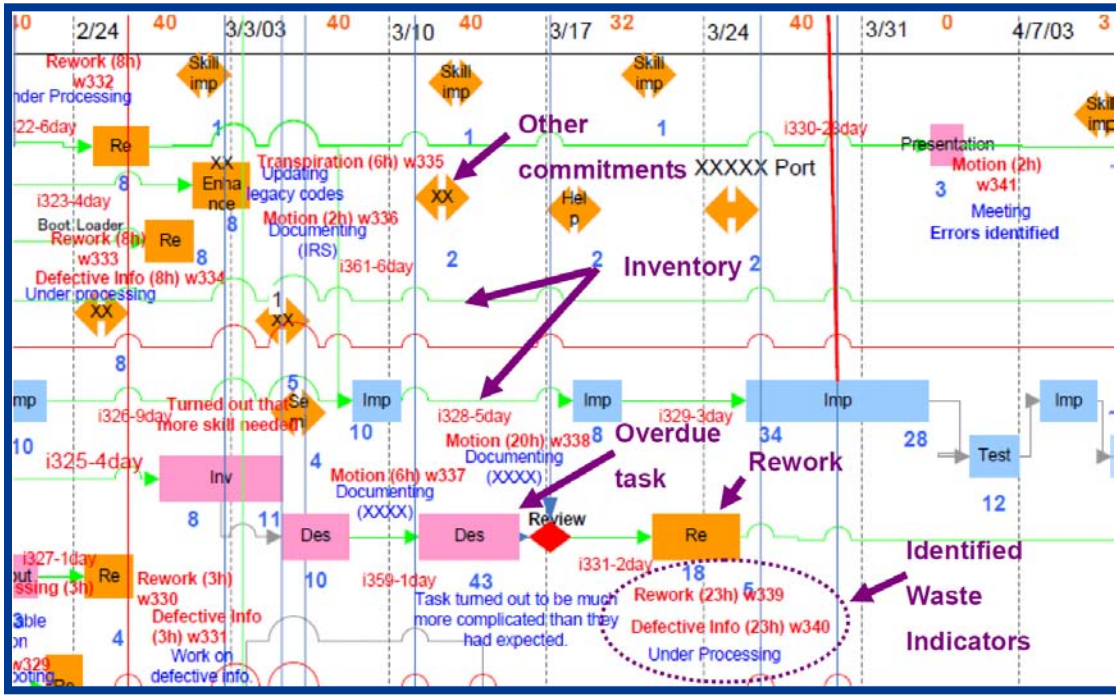
Example Value Stream Maps: All shapes and sizes



Source: Wikipedia

1 type of waste, one value stream

7 types of waste, three coupled value streams



Source: Kato 2005

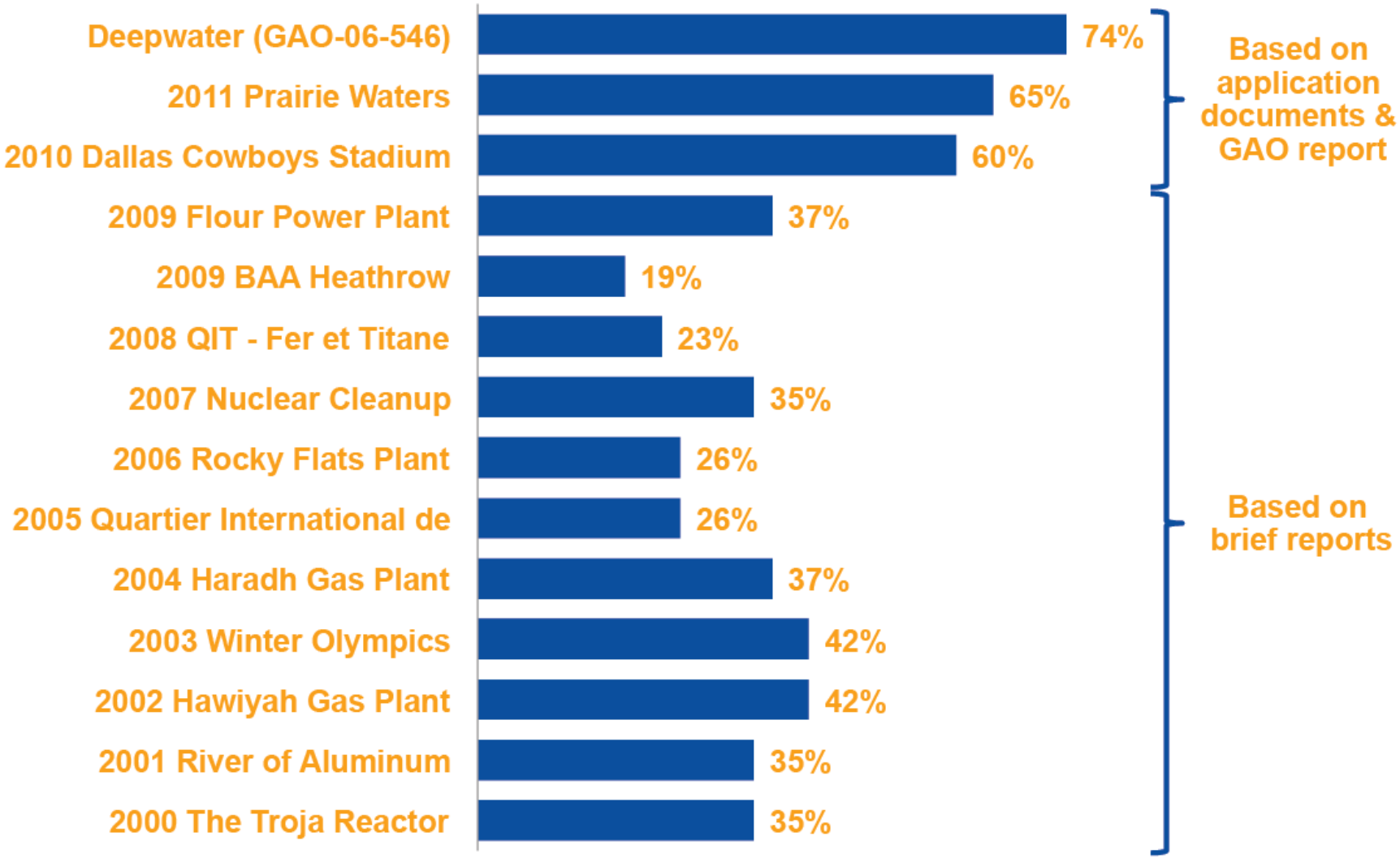
Reducing Work in Progress through simple visual management (and prioritization)

- Average from 972 cases at Boeing:
  - Reduction of work in progress: 69%
  - Improvement of quality (reduction of defects): 3.2x
  - Improvement of throughput (reduction of lead time): 3.4x
  - Time to implement method: 4 weeks

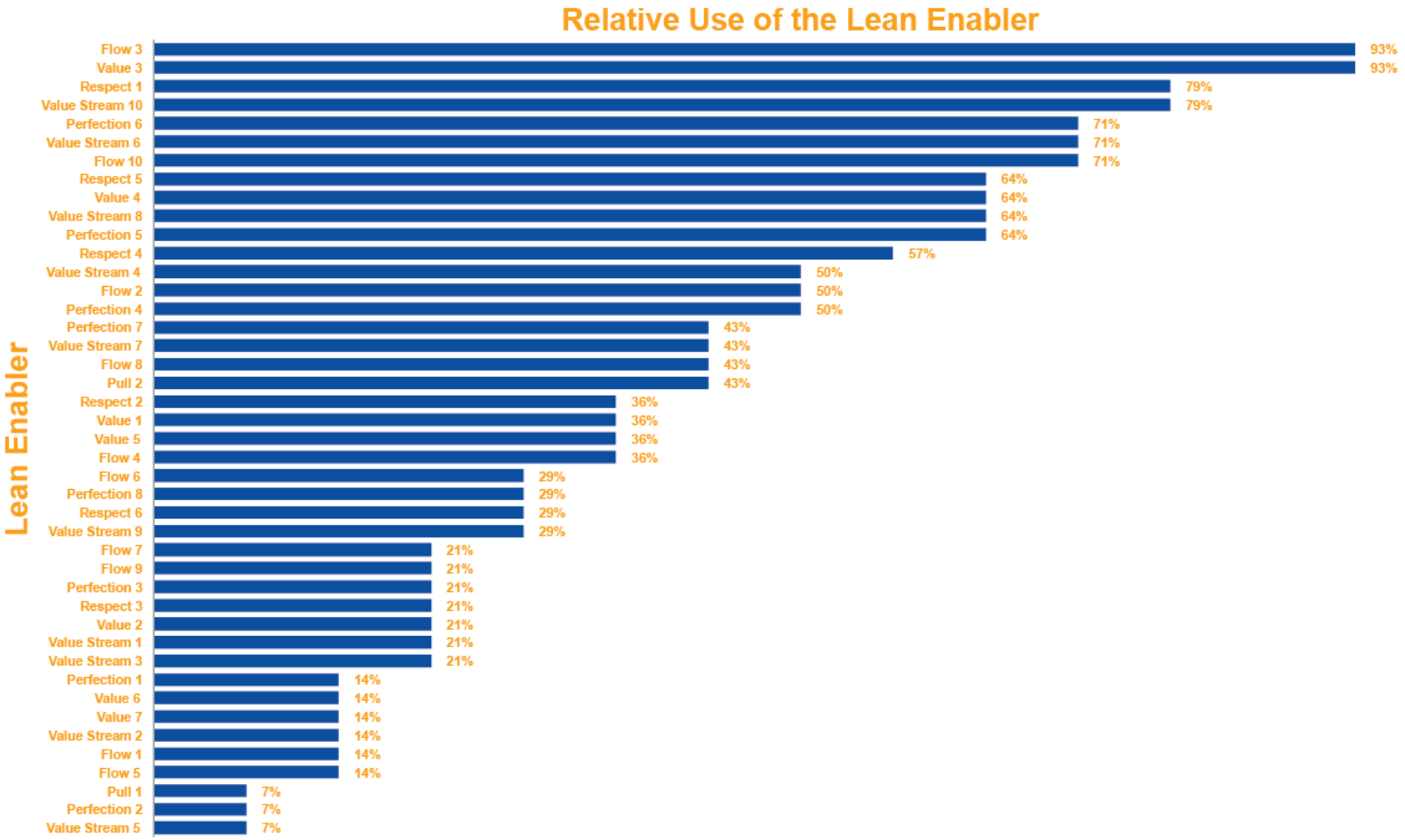
LEAN ENABLERS AND PROGRAM SUCCESS

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

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

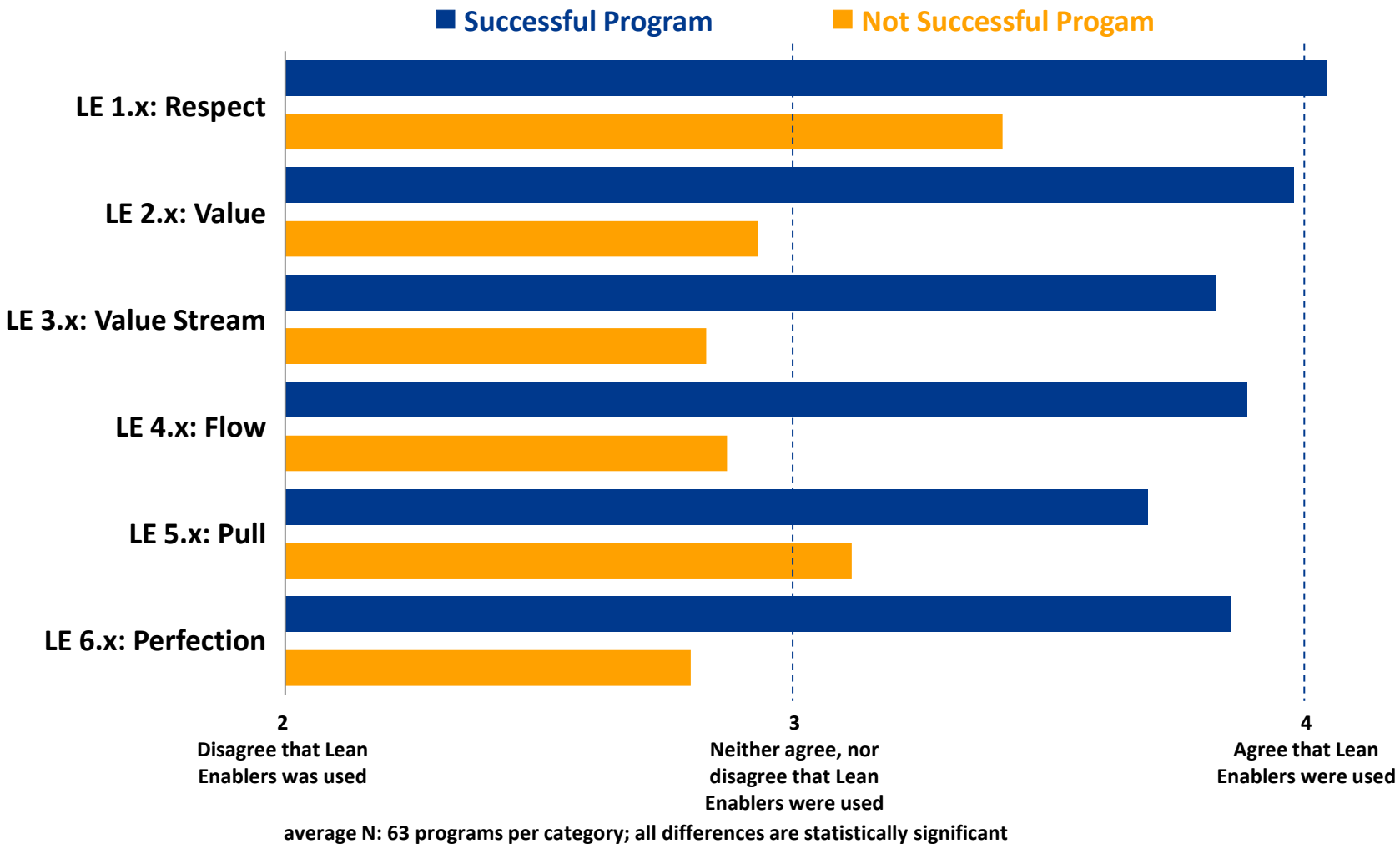
- **Build a program culture based on respect for people**
- For every program, use a program manager role to lead and integrate program from start to finish
- Frequently engage the stakeholders throughout the program lifecycle
- Develop a Communications Plan

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

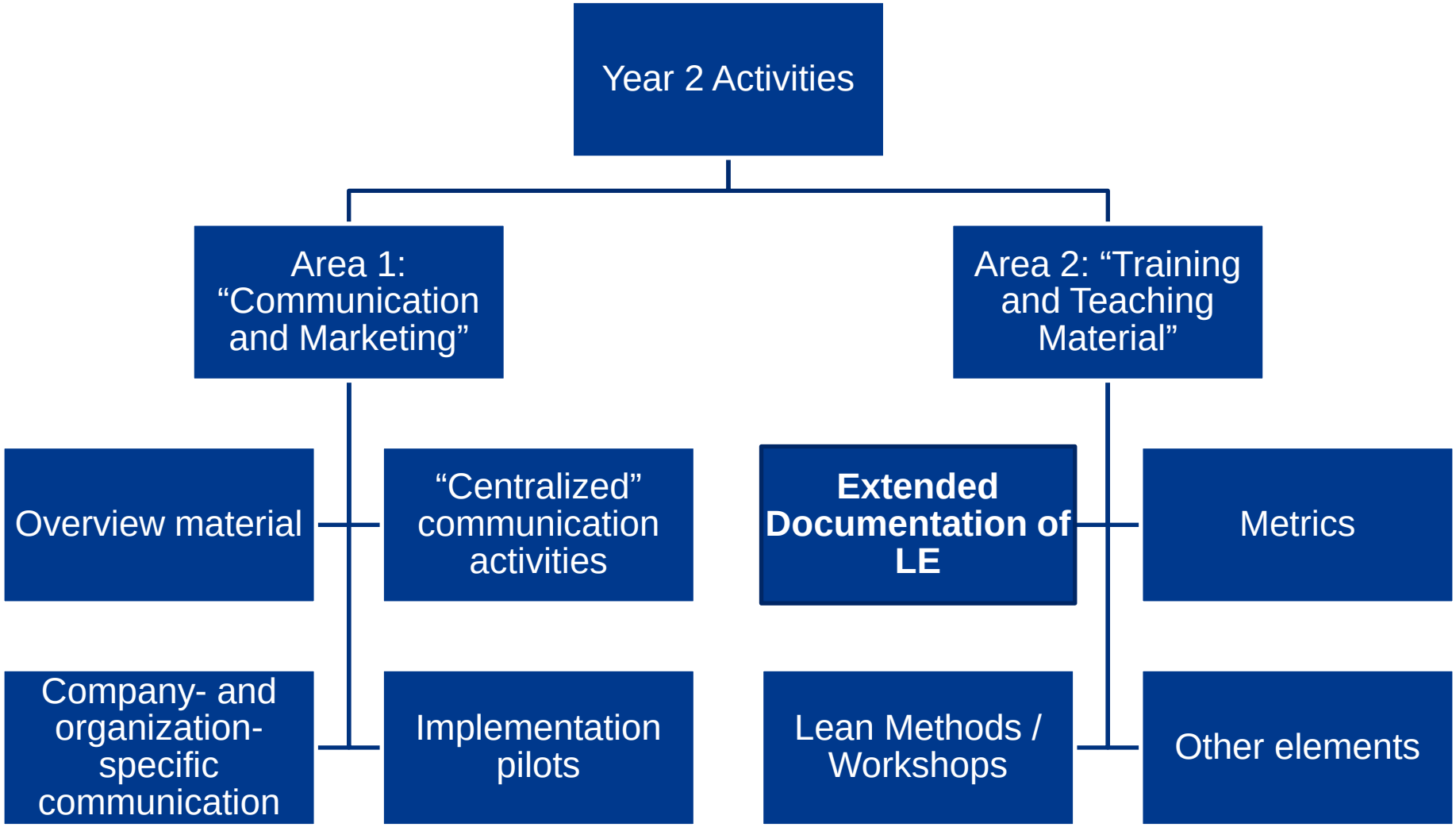
Use of Lean Enablers in Successful and Unsuccessful Programs: Level of Agreement of Respondents



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

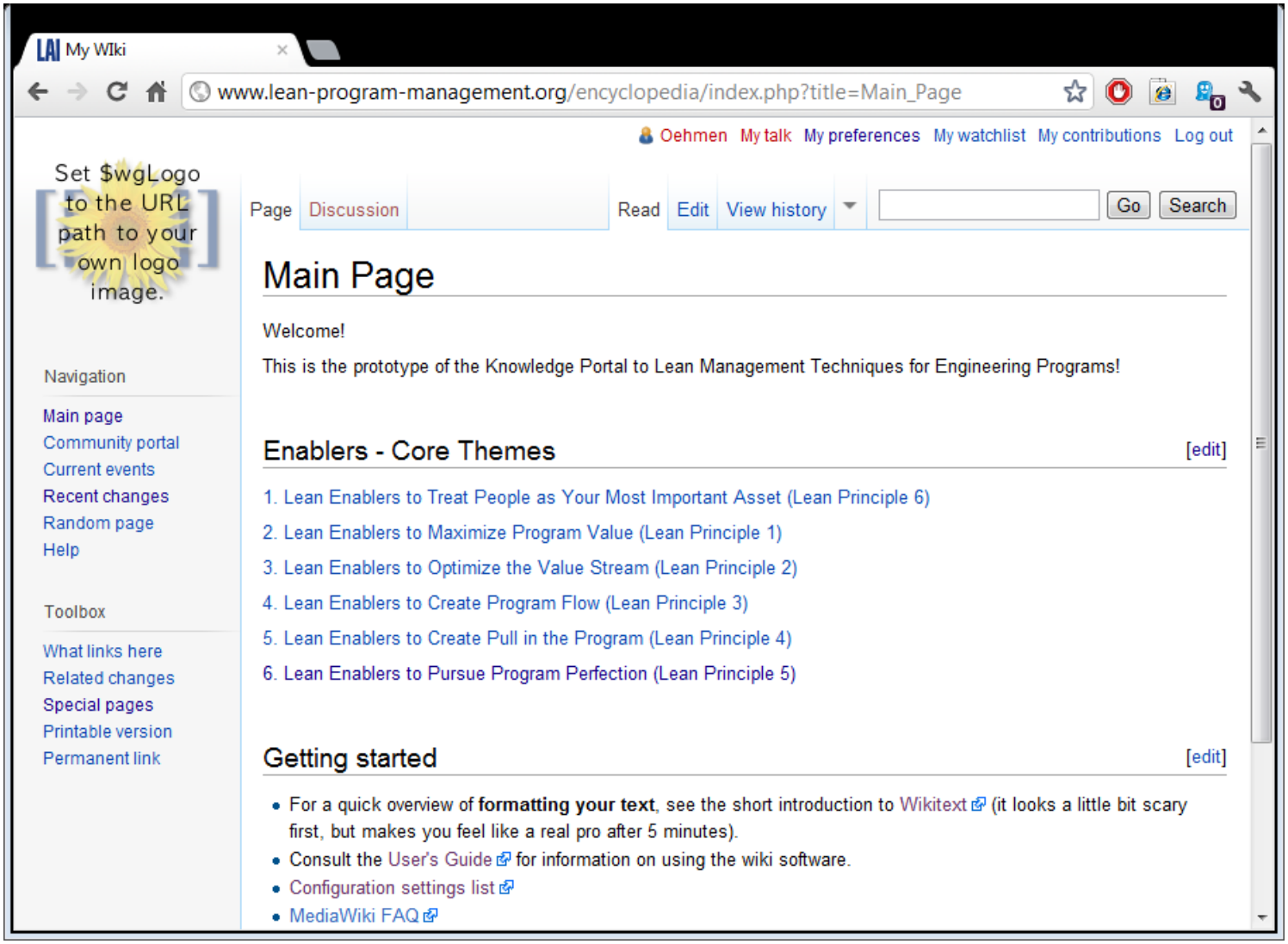
THE ROAD AHEAD

Overview of Year 2 Activities – Working Draft



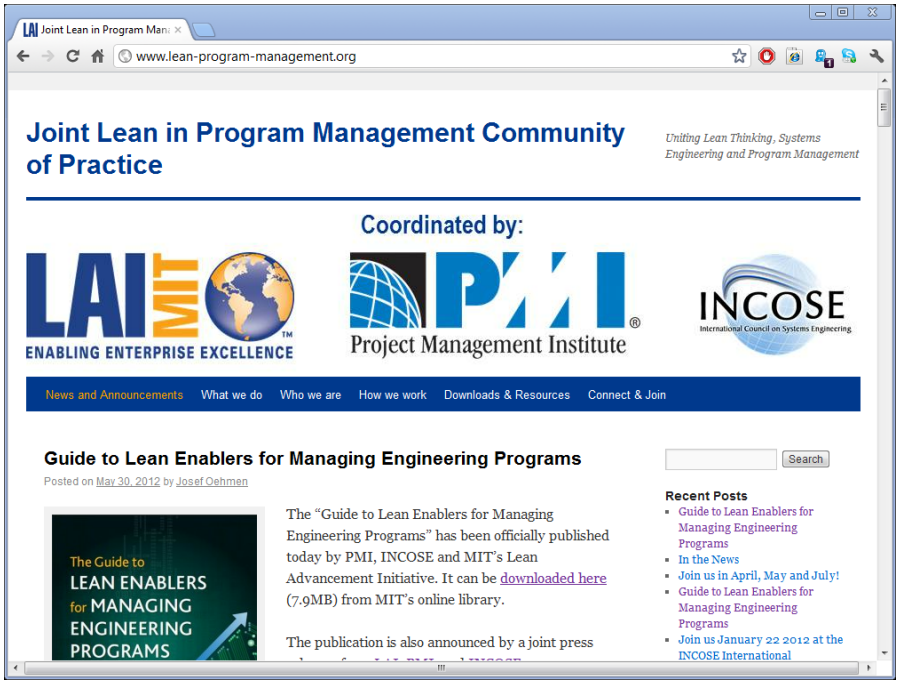
"Format" of Area 2 activities: Open Knowledge Portal

Currently: Proof of Concept & Prototyping Activities



JOIN US!

www.lean-program-management.org



- Join the mailing list – one email and presentation per month.
- Become a subject matter expert – Monday, 1-2pm EDT