Lessons Learned from Collecting Systems Engineering Data

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Outline

- Introduction & motivation
- Systems Engineering (SE) sizing with COSYSMO
- 11 lessons learned
- Conclusions

Introduction & Motivation

- Constructive Systems Engineering Cost Model (COSYSMO)
  - COCOMO II family
  - Development began in 2001
- Extensive practitioner support
  - PSM, ISPA, INCOSE, CSE Corporate Affiliates
- Historical project data & industry calibration enables
  - understanding the model's robustness
  - establishment of initial relationships between parameters and outcomes
  - validation of drivers
- Challenge is that SE measurement is not standardized
- Model development process has yielded 11 lessons learned

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Counting Guides for Sizing Systems Engineering

Driver Name	Data Item
# of System Requirements	Counted from system specification
# of Interfaces	Counted from interface control document(s)
# of Operational Scenarios	Counted from test cases or use cases
# of Critical Algorithms	Counted from system spec or mode description docs

Effort Multipliers

Driver Name	Data Item
Requirements Understanding	Subjective assessment of the system reqs
Architecture Understanding	Subjective assessment of the system arch
Level of Service Requirements	Subjective difficulty of satisfying the key performance parameters
Migration Complexity	Influence of legacy system (if any)
Technology Risk	Maturity, readiness, and obsolescence of technology
Documentation to Match Life Cycle Needs	Breadth and depth of required documentation
# and Diversity of Installations/ Platforms	Sites, installations, operating environment, and diverse platforms
# of Recursive Levels in the Design	Number of levels of the Work Breakdown Structure

Effort Multipliers

Driver Name	Data Item
Stakeholder team cohesion	Subjective assessment of all stakeholders
Personnel/team capability	Subjective assessment of the team's intellectual capability
Personnel experience/ continuity	Subjective assessment of staff consistency
Process capability	CMMI level or equivalent rating
Multisite coordination	Location of stakeholders and coordination barriers
Tool support	Subjective assessment of SE tools

Lessons Learned

Lesson #1: Scope of the model

A standardized WBS and dictionary provides the foundation for decisions on what is within the scope of the model for both data collection and for estimating

Lesson #2: Types of projects needed for data collection effort

Careful examination of potential projects is necessary to ensure completeness, consistency and accuracy across all required data collection items for the project

Lesson #3: Size drivers

The collection of the size driver parameters requires access to project technical documentation as well as project systems engineering staff that can help interpret the content

Lessons Learned

Lesson #4: Effort Multiplier

The rating of effort multiplier parameters for a completed project requires an assessment from the total project perspective

Lesson #5: Systems Engineering hours across life cycle stages

Agree on a standardized set of life cycle stages for the model despite the different processes used by Affiliate companies

Lesson #6: Data collection form

The data collection form must be easy to understand and flexible enough to accommodate organizations with different levels of detail so that they can contribute data and use the model

Lessons Learned

Lesson #7: Definition

Spending more time on improving the driver definitions has ensured consistent interpretation and improved the model's validity

Lesson #8: Significance vs. data availability

If no data can be collected for a particular driver then that driver cannot be used because its influence on systems engineering effort cannot be validated

Lesson #9: Influence of data on the drivers and statistical significance

Historical data can help determine which drivers should be kept in the model and which should be discarded

Lessons Learned

Lesson #10: Data safeguarding procedure

Establishing non-disclosure agreements early on in the process enables the data sharing and collaboration to easily take place

Lesson #11: Buy-in from constituents

The success of the model hinges on the support from the end-user community

Conclusions

- Great support from practitioners during the development
  - Industry team resonated with critical need for model; and
  - Facilitated data source identification and collection
- Lessons learned are applicable to
  - parametric model building
  - systems engineering measurement
- More lessons to be learned as we proceed to model calibration

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COSYSMO prototype v1.19 available at: http://www.valerdi.com/cosysmo