Convergence of Expert Opinion via the Wideband Delphi Method: An Application in Cost Estimation Models

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Dr. Ricardo Valerdi
Massachusetts Institute of Technology
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[rvalerdi@mit.edu]

Theory is when you know everything, but nothing works.

Practice is when everything works, but no one knows why.

Harvard is where theory and practice come together...

Nothing works and no one knows why.

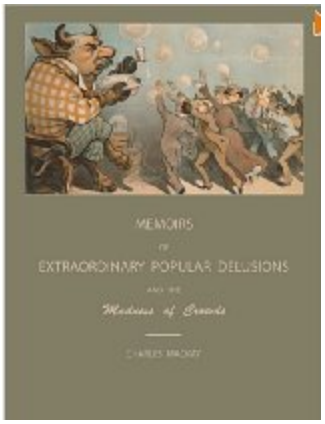
- on the door of a
laboratory at Harvard

Bottom Line Up Front

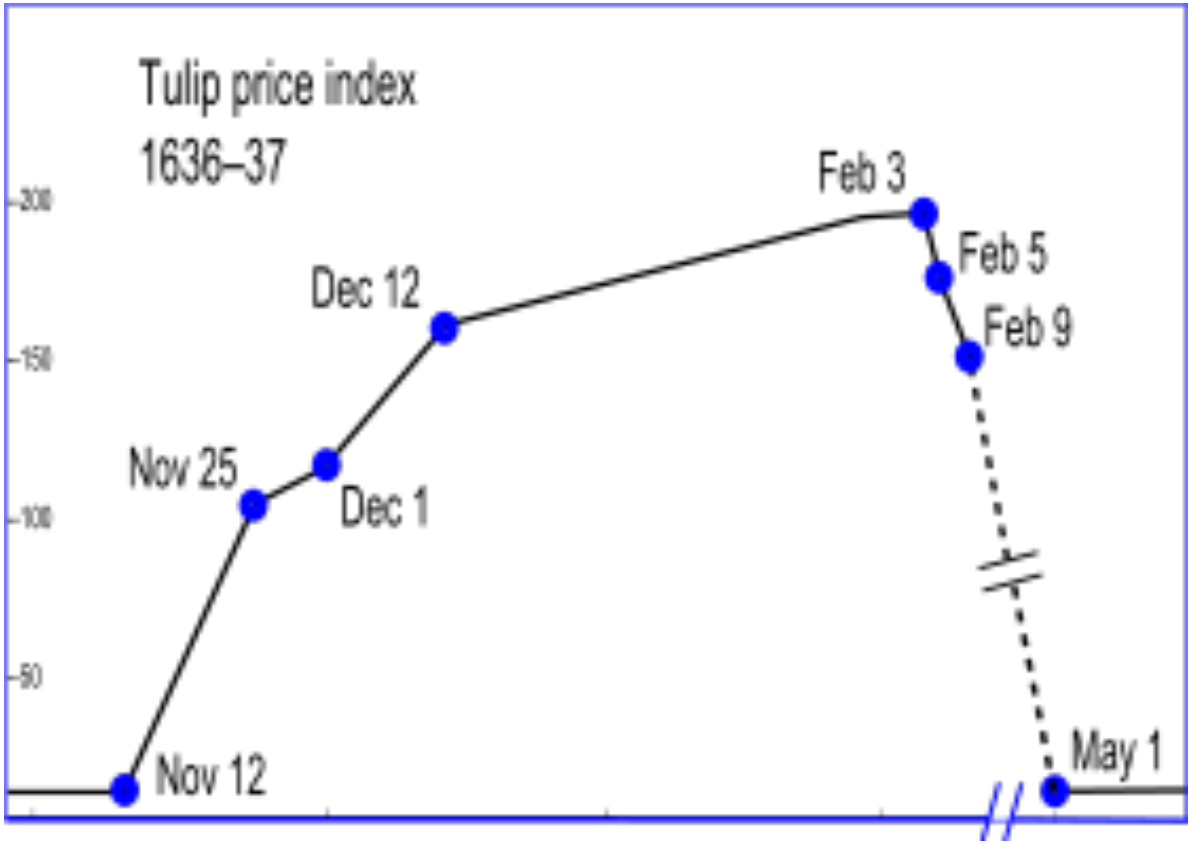
3

The Delphic Sybil
Michelangelo Buonarroti
Capella Sistina, Il Vaticano (1508-1512)

Madness of Crowds



Tulip mania (Netherlands circa 1630)

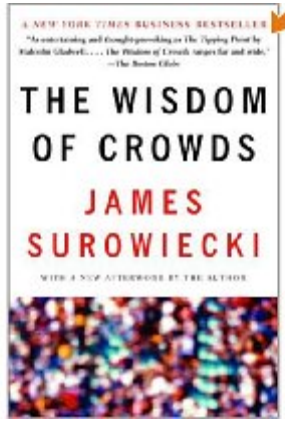


Charles MacKay, *Extraordinary Popular Delusions and the Madness of Crowds*, with a foreword by Andrew Tobias (1841; New York: Harmony Books, 1980).

Wisdom of Crowds

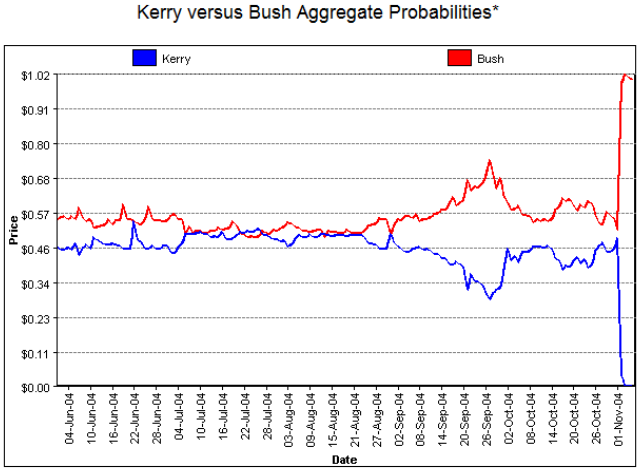
Four elements required to form a wise crowd

1. Diversity of opinion
   - Each person has private information
2. Independence
   - Opinions aren't influenced by others
3. Decentralization
   - Specialization and local knowledge
4. Aggregation
   - Mechanism for collective decisions

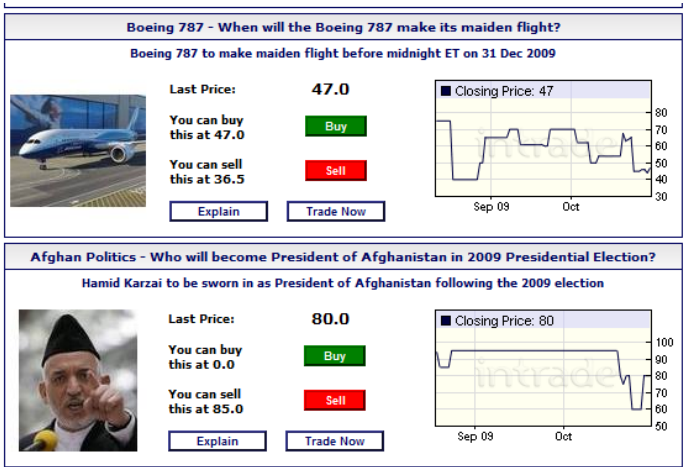


Surowiecki, J., (2004). *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations* Little, Brown

Prediction Markets: Examples



Produced by: Iowa Electronic Markets, University of Iowa Tippie College of Business



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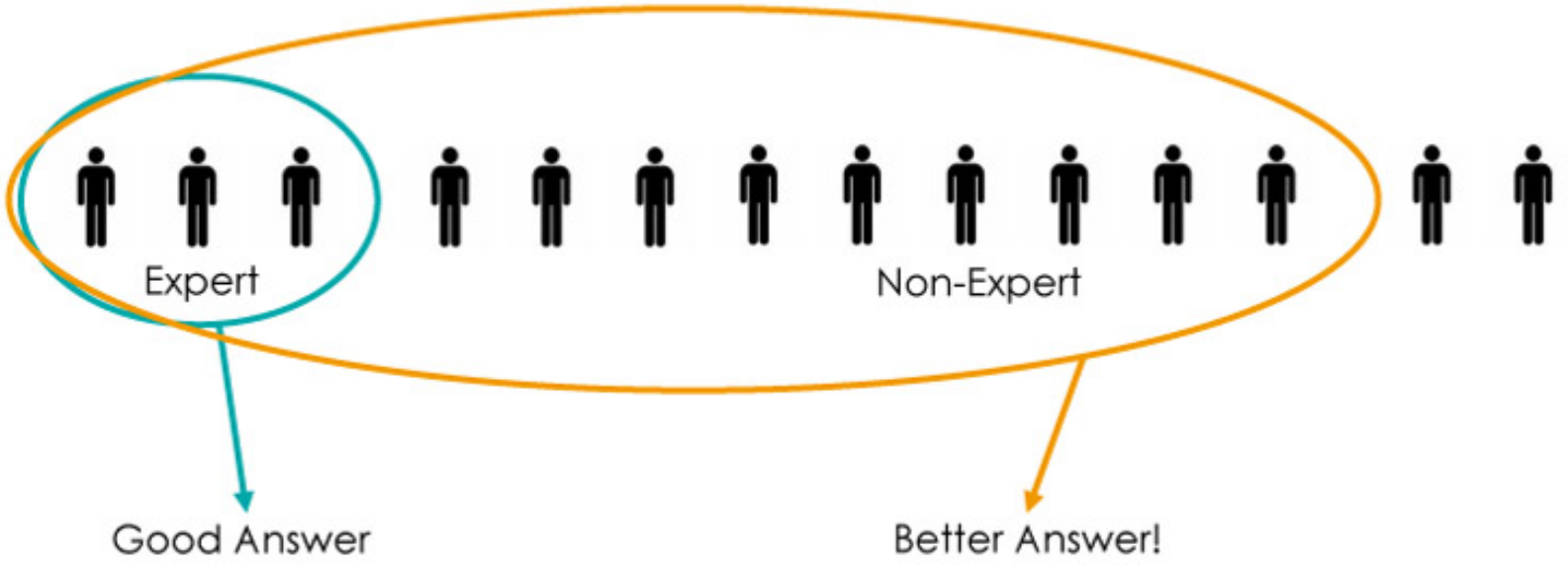
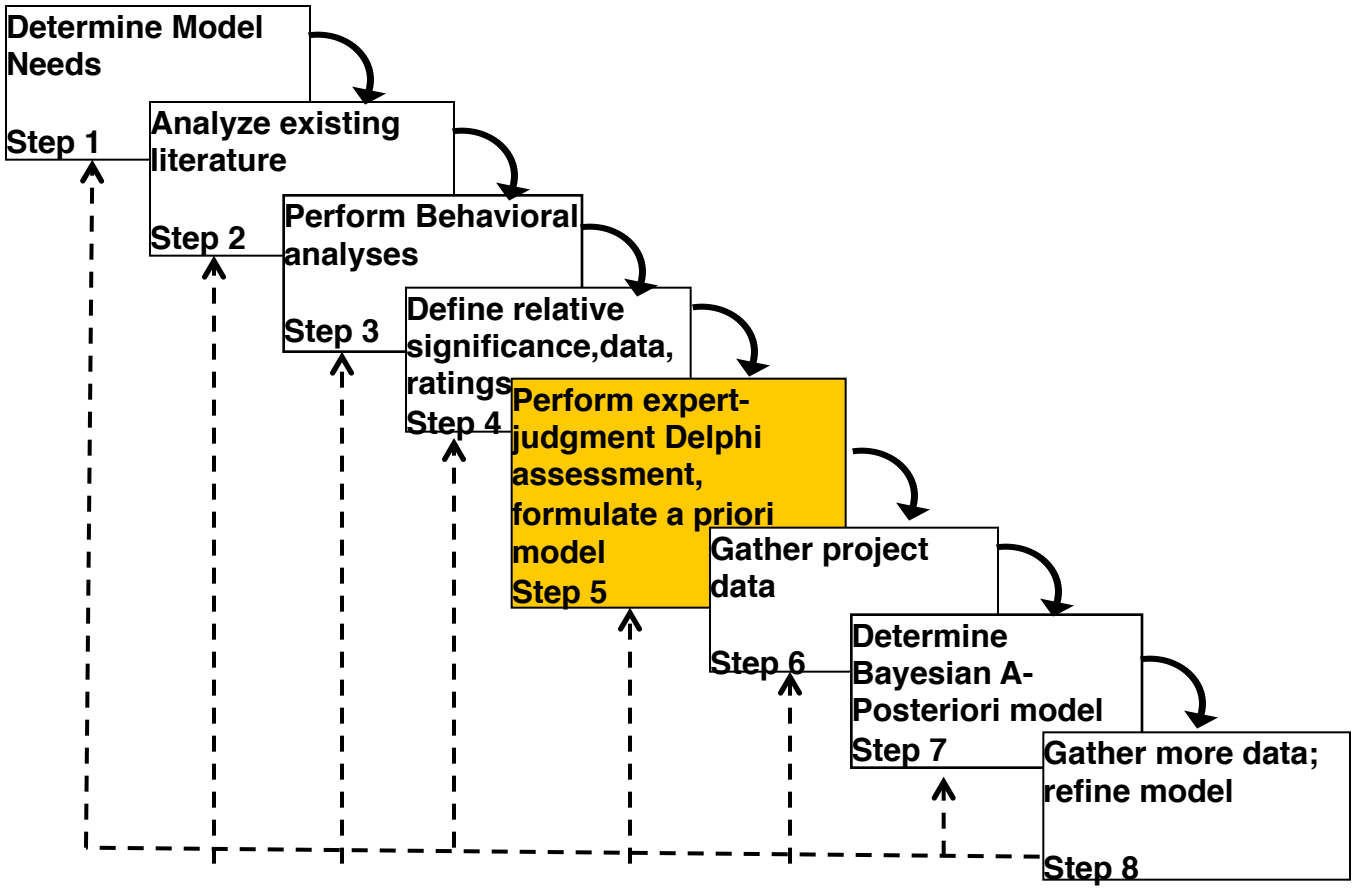


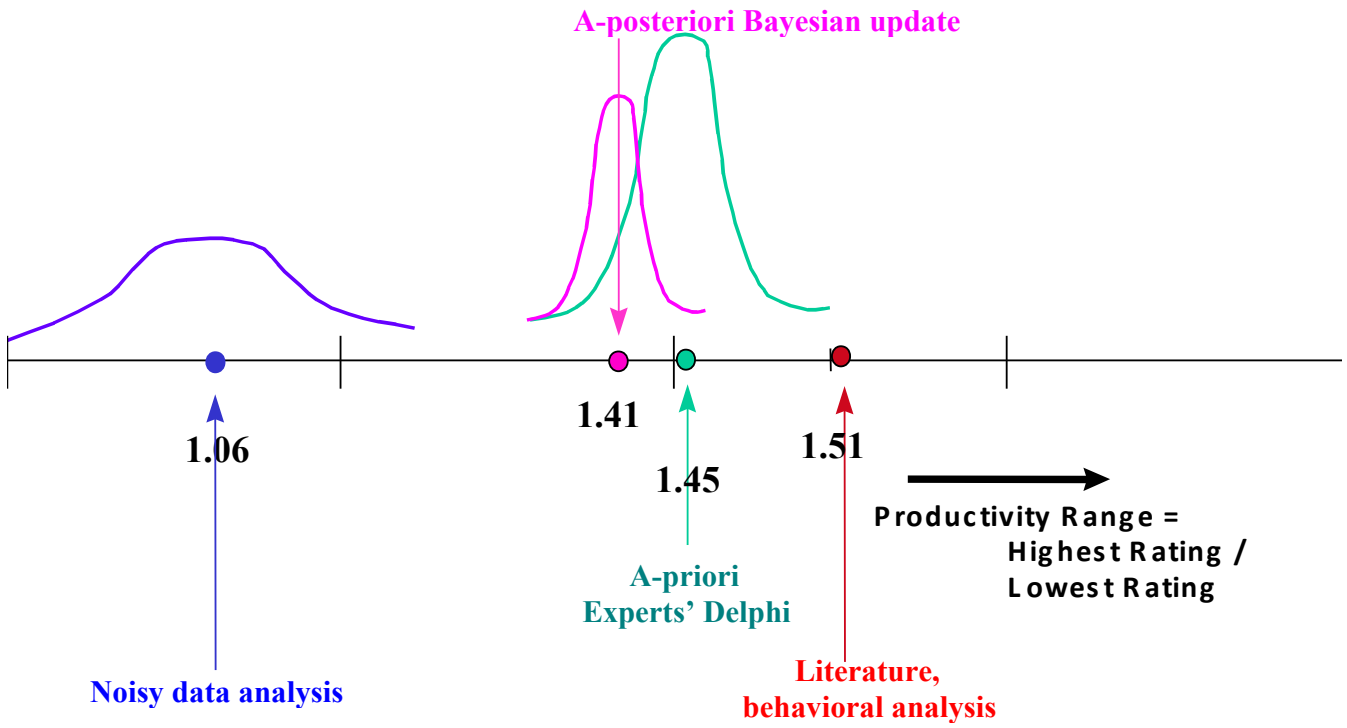
http://www.crowdclarity.com/learnmore.htm

Modeling Methodology

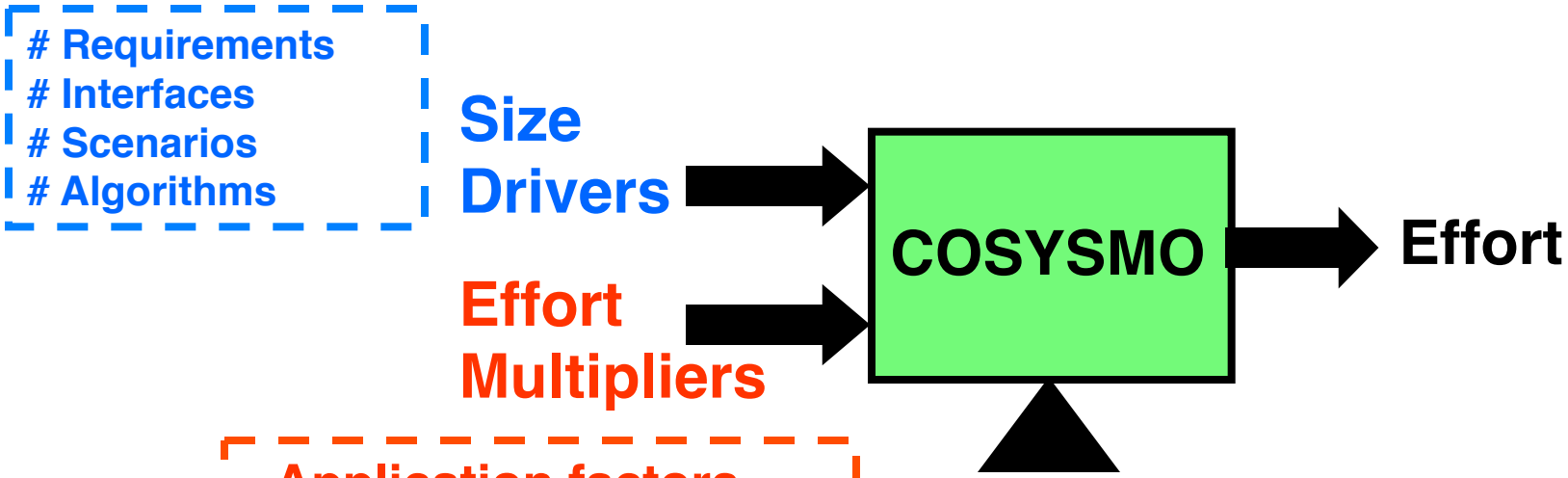
- concurrency and feedback implied



Results of Bayesian Update: Using Prior and Sampling Information



COSYSMO Operational Concept

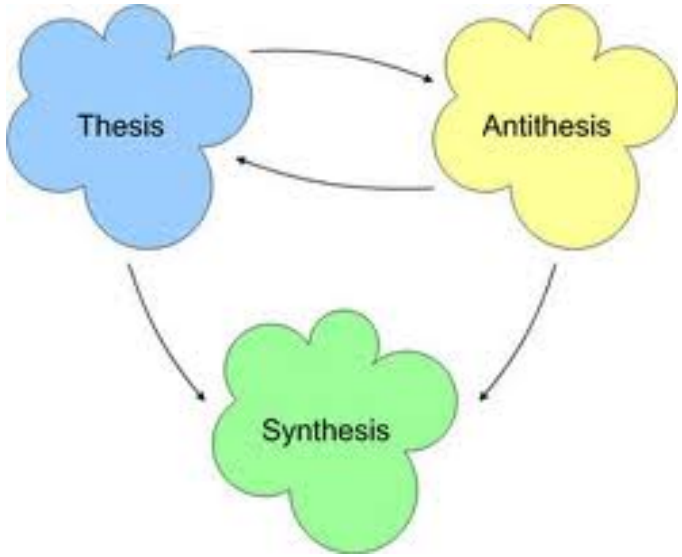


WBS guided by EIA/ANSI 632

Hypothesis

The Wideband Delphi method enables convergence of opinion between experts after 3 rounds.

Hegelian Principle



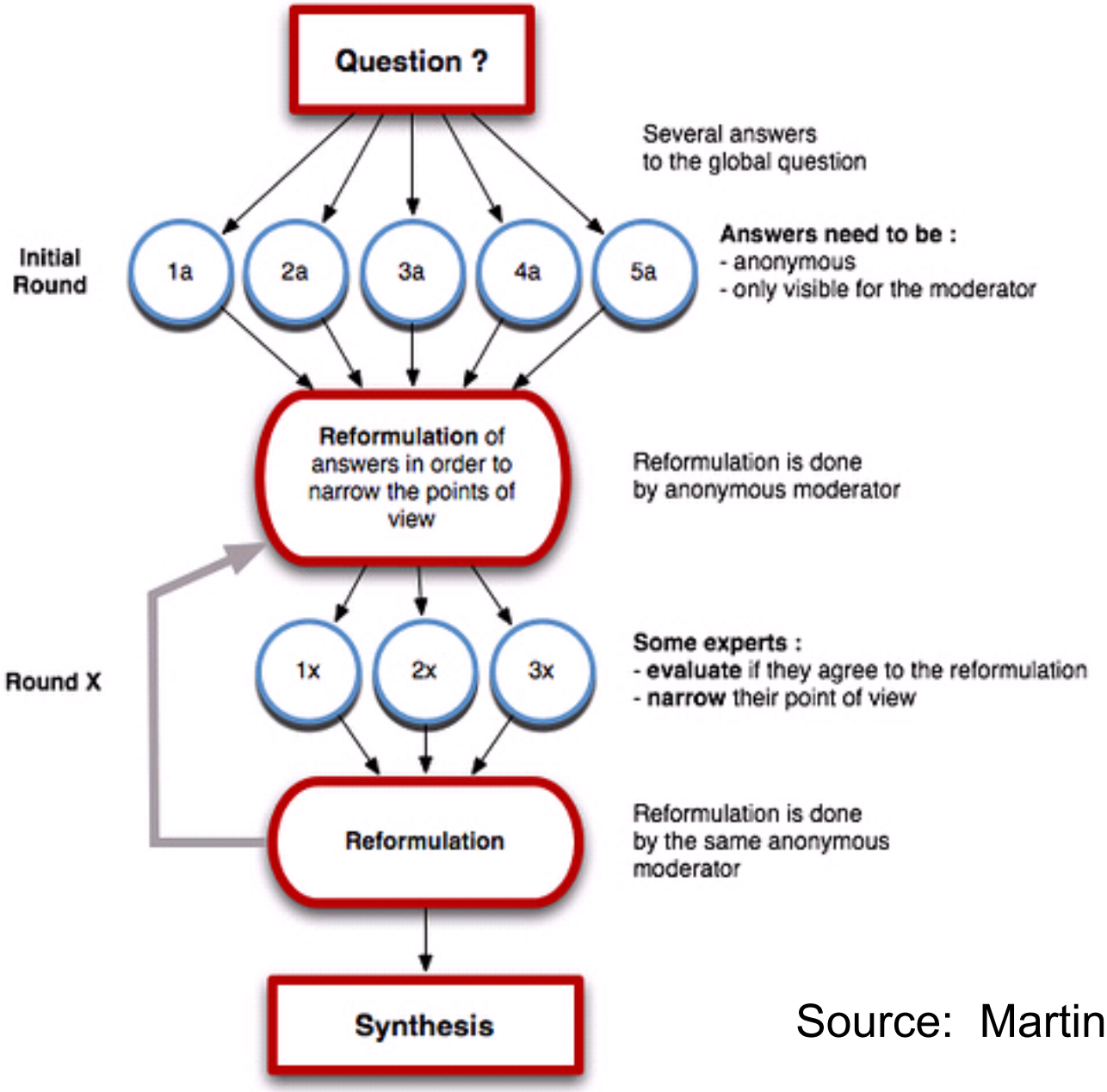
Delphi History and Variations

- RAND/Douglas Aircraft Company (1946)
- To leverage domain experts to forecast issues in inter-continental warfare
- Variations: Policy Delphi, Trend Delphi, Delphi II, Problem Solving Delphi, Imen-Delphi, etc.
- Main objective: **to help structure group communication to enable a group of individuals to deal with a complex problem**

Applications of the Delphi Method

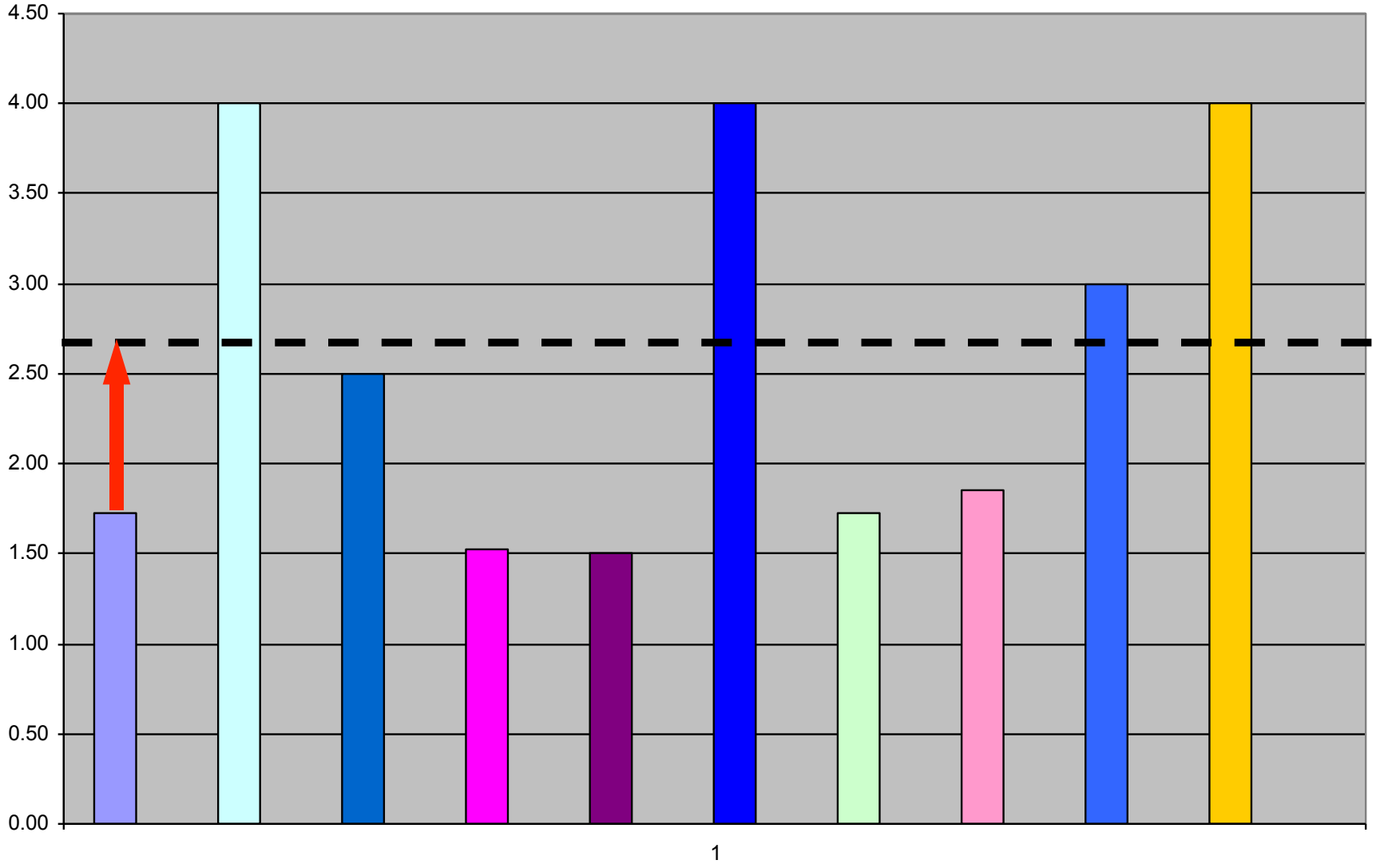
- Policy formulation
- Science and technology planning
- Tourism potential
- Software engineering training needs
- Futures thinking
- Educational counseling
- Pharmaceutical processes
- Nursing
- Cost modeling
- Cost estimation

Planning Poker



Source: Martin Erpicum

COSYSMO Requirements Understanding Delphi

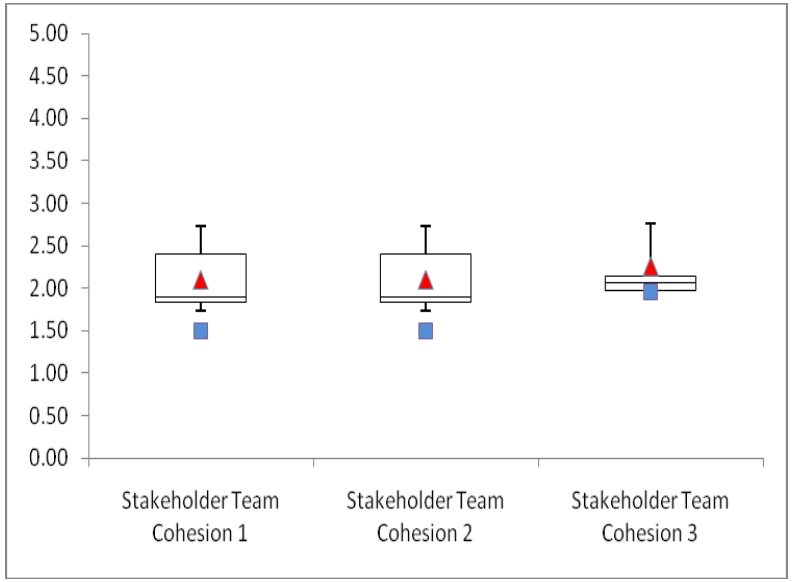


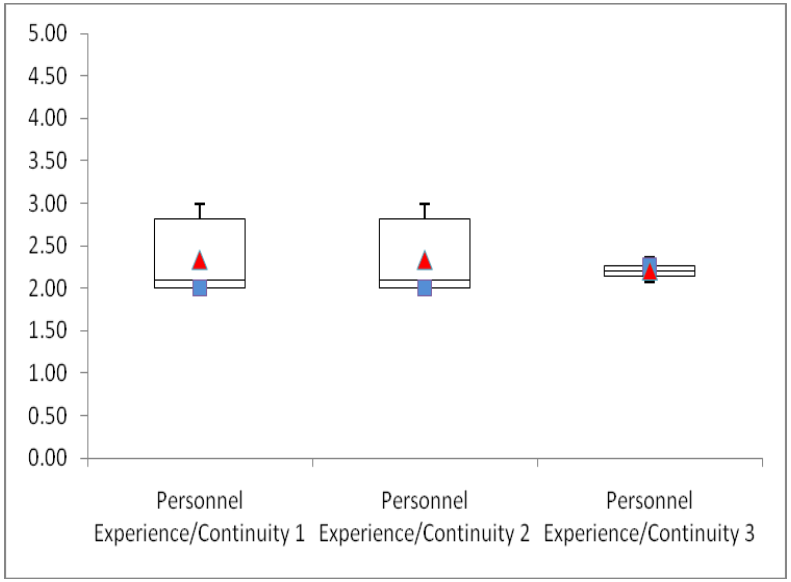
Convergence of Expert Opinion

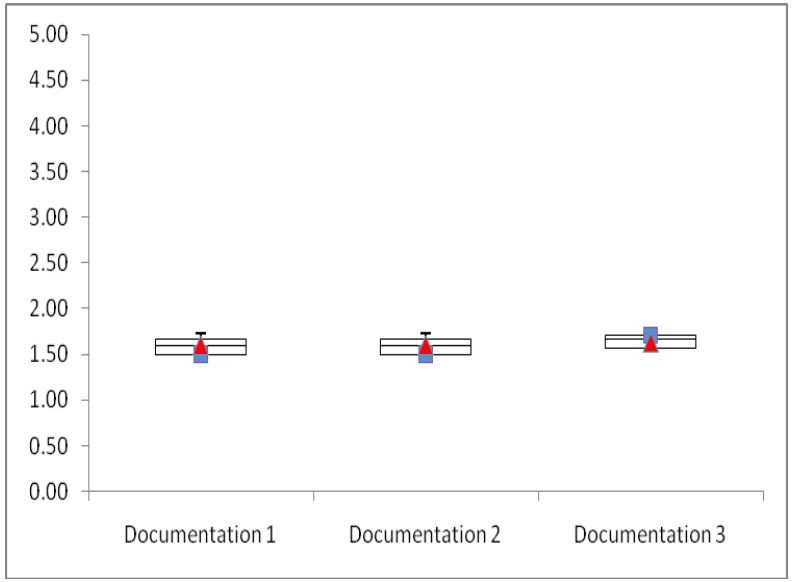
- Reduction of standard deviation over time
- Coefficient of variation
  - $c_v = \sigma/\mu$

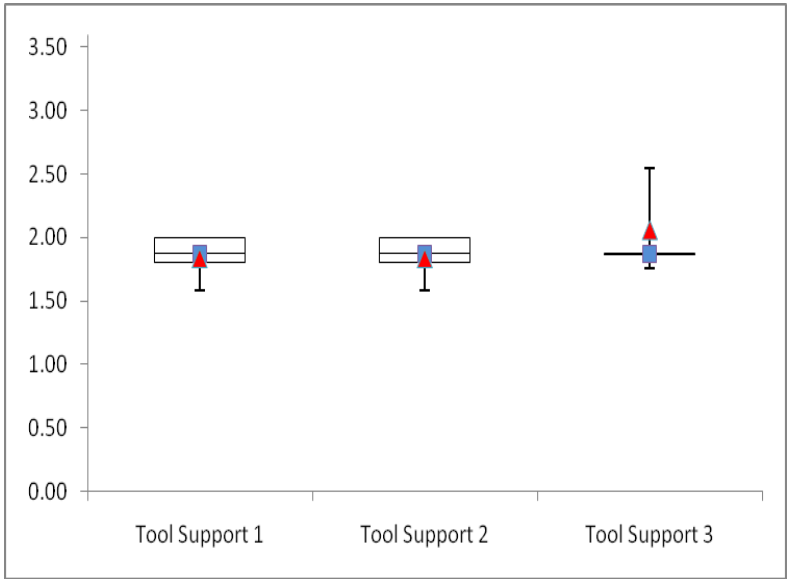
Cost Driver	Round 1 c_v	Round 2 c_v	Round 3 c_v
Requirements Understanding	0.44	0.41	0.34
Architecture Understanding	0.34	0.32	0.34
Level of Service Requirements	0.22	0.20	0.21
Migration Complexity	0.12	0.11	0.20
Technology Risk	0.20	0.18	0.15
Documentation to match lifecycle needs	0.08	0.07	0.06
# and diversity of installations/platforms	0.19	0.18	0.09
# of recursive levels in the design	0.27	0.25	0.07
Stakeholder team cohesion	0.25	0.23	0.24
Personnel/team capability	0.24	0.22	0.16
Personnel experience/continuity	0.23	0.22	0.07
Process capability	0.20	0.18	0.17
Multisite coordination	0.07	0.07	0.17
Tool support	0.11	0.10	0.26

Convergence of Expert Opinion









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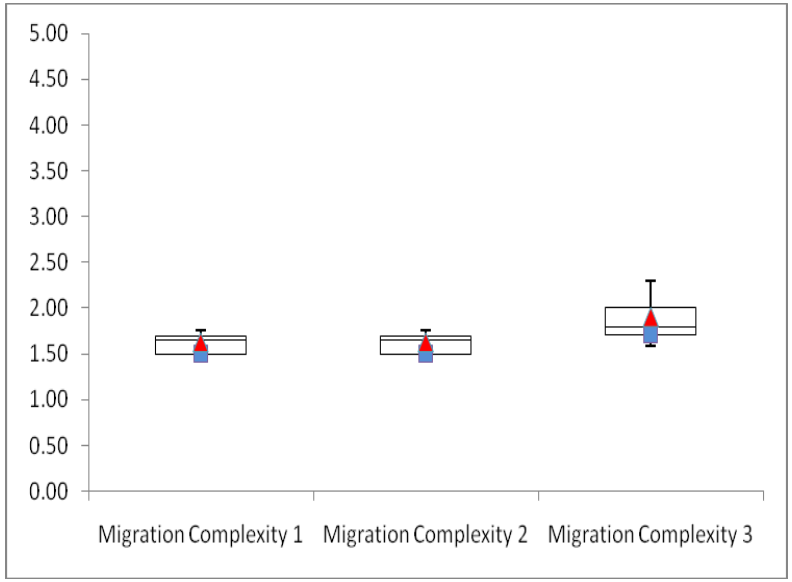
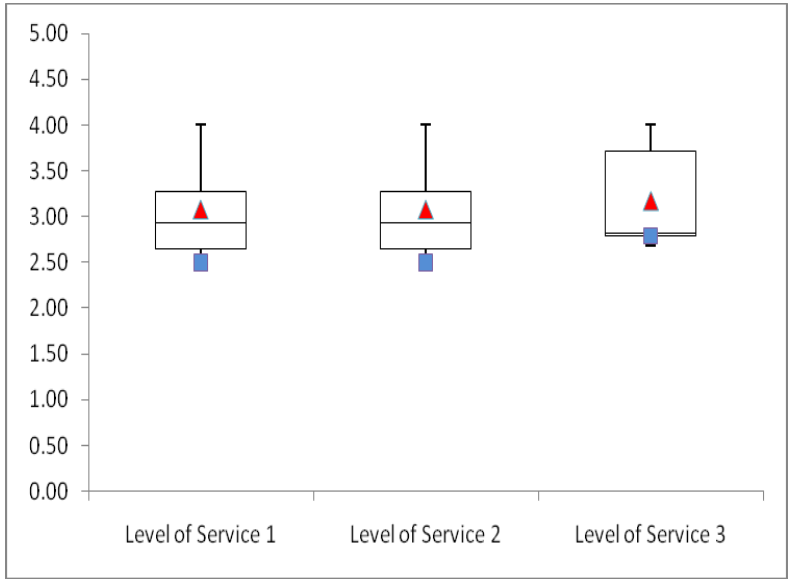
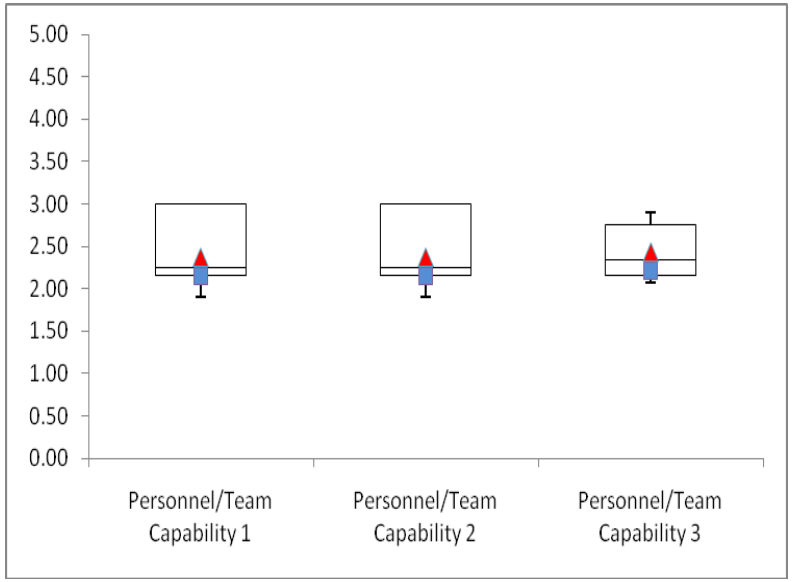
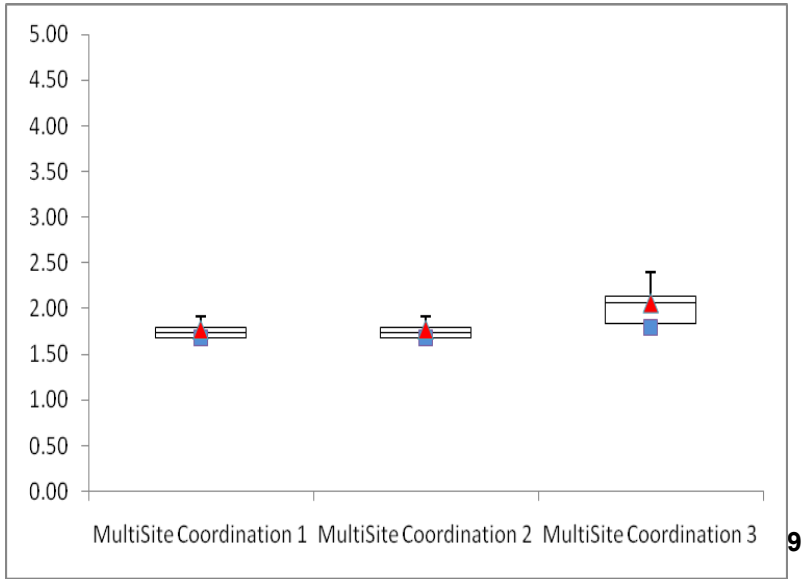
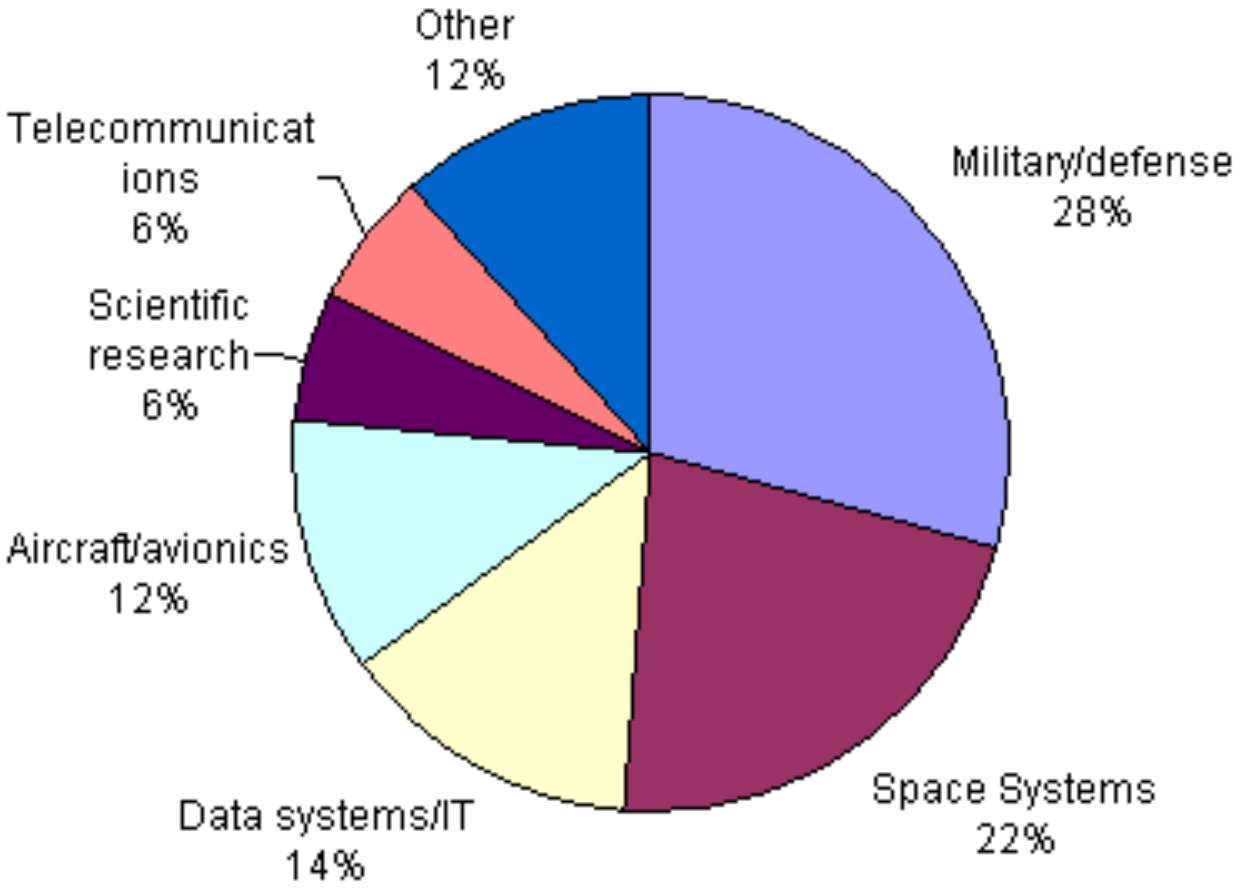








Delphi Respondents (n = 40)



Threats to Validity

- Low reliability
- Internal consistency
- Morbidity
- Expertise
- High barrier of entry
- Anchoring
- False consensus bias
- Anthropic bias

Contact

Ricardo Valerdi

MIT

rvalerdi@mit.edu

(617) 253-8583

http://rvalerdi.mit.edu