Incorporating Maturity Assessment into the House of Quality for Improved Decision Support Analysis and Risk Management

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I would like to take a moment to thank the men and women who over the last several years have been instrumental in shaping in the research that I am about to present before you today. Without their support, contribution, and unfaltering resolve to freely share information, this work would not have been possible.

George Washington University

Stevens Institute

Department of the Army

Department of the Air Force

Agenda

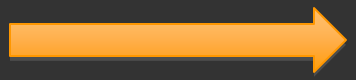
technology maturity track 8770

- Problem Statements
- Maturity Metrics
- Proposed Solution
- HoQ Overview
- Integration Approach
- Academic Example
- Conclusion

Problem Statements

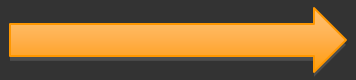
new acquisition lifecycles without supporting methods

Characteristics of Modern Acquisitions
Evolving Requirements
System Emphasis
Globalization
International Competition
Prolonged Lifecycles
Complexity



Issue: Technology life cycles are outpacing system life cycles

New Approaches / Philosophies
Cradle to Grave Life Cycle
Total Package Approach (TPA)
Technology Insertion
Introduction of Maturity Metrics

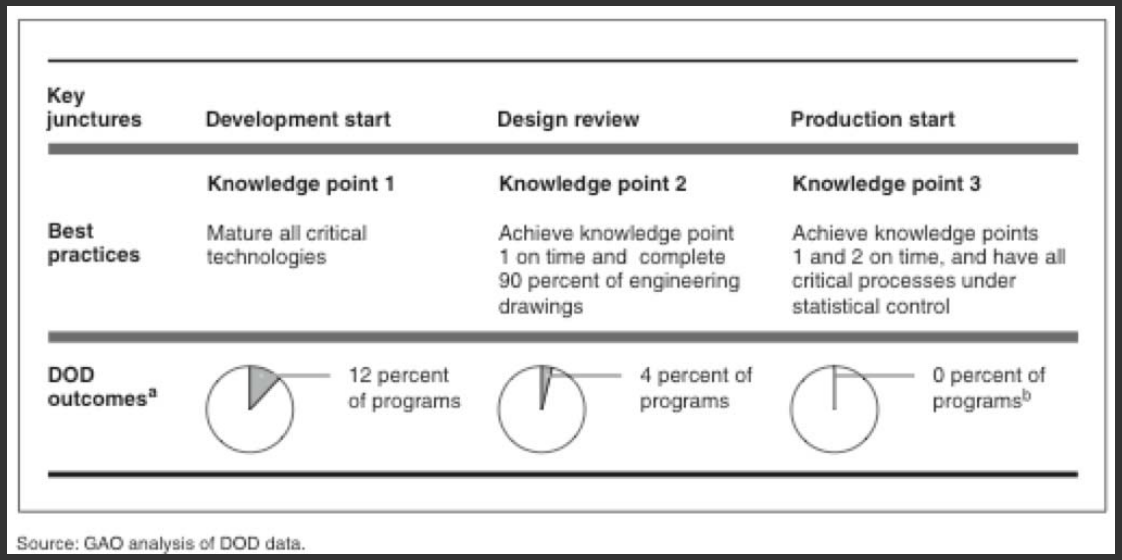


Issue: Lack of dynamic processes to account for new acquisition strategies, specifically with respect to maturity

Problem Statements

continued. GAO 2008 report

"None of the weapon programs we assessed had proceeded through system development meeting the best practices standards for mature technologies, stable design, and mature production processes—all prerequisites for achieving planned cost, schedule, and performance outcomes. In addition, only a small percentage of programs used two key systems engineering tools—preliminary design reviews and prototypes to demonstrate the maturity of the product's design by critical junctures. This lack of disciplined systems engineering, especially prior to starting system development, affects DOD's ability to develop sound business cases for programs and can contribute to contract cost increases and long development cycle times (GAO, 2008)."

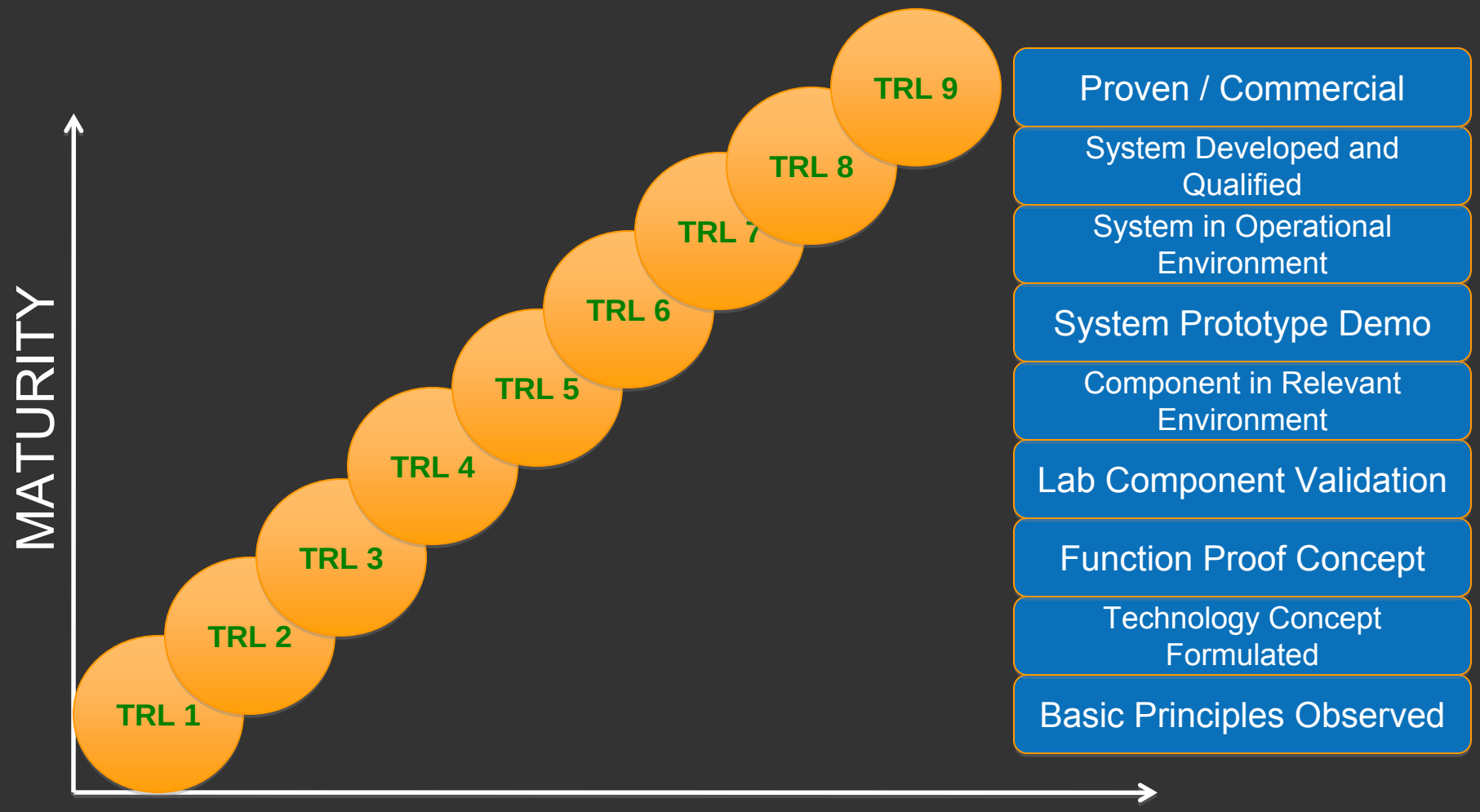


Key junctures	Development start	Design review	Production start
	Knowledge point 1	**Knowledge point 2**	**Knowledge point 3**
Best practices	Mature all critical technologies	Achieve knowledge point 1 on time and complete 90 percent of engineering drawings	Achieve knowledge points 1 and 2 on time, and have all critical processes under statistical control
DOD outcomes[a]	12 percent of programs	4 percent of programs	0 percent of programs[b]

Source: GAO analysis of DOD data.

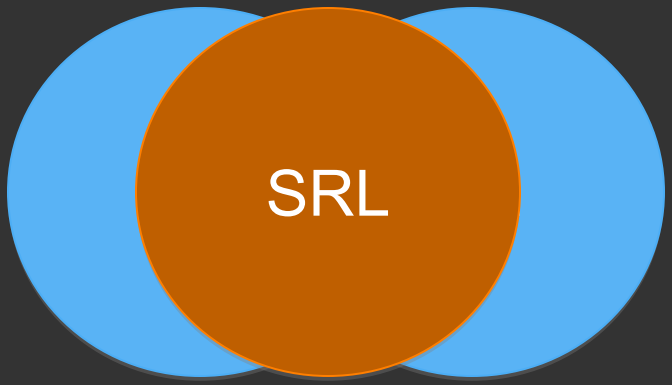
Problem Statements

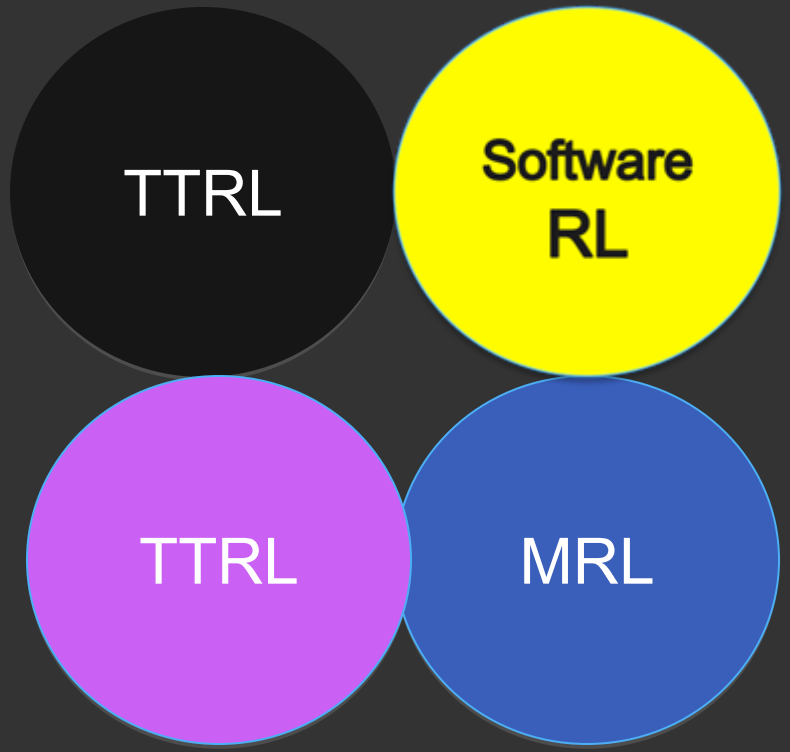
continued. what about TRAs and TRLs?



Maturity Metrics

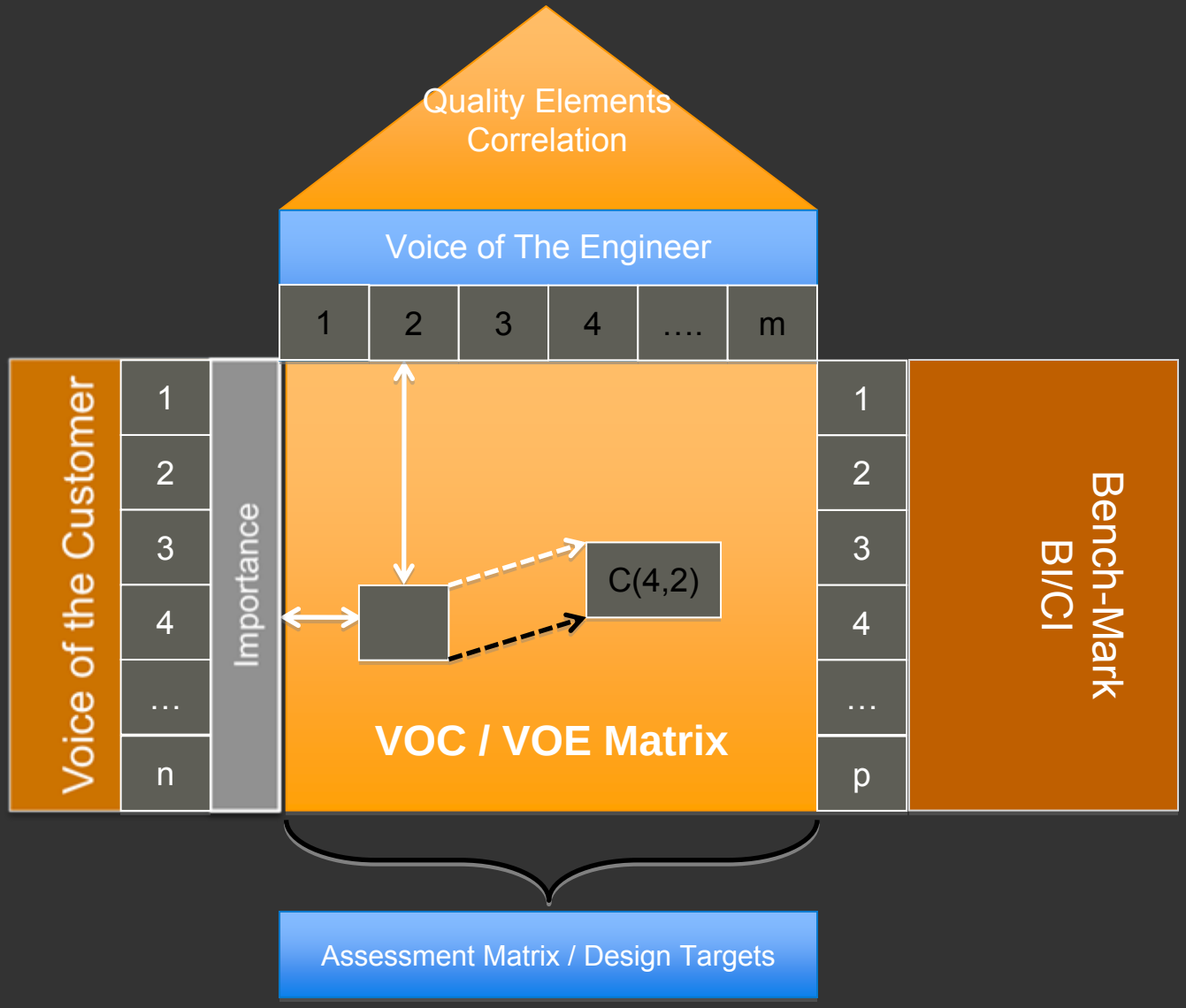
are there more than just TRLs?





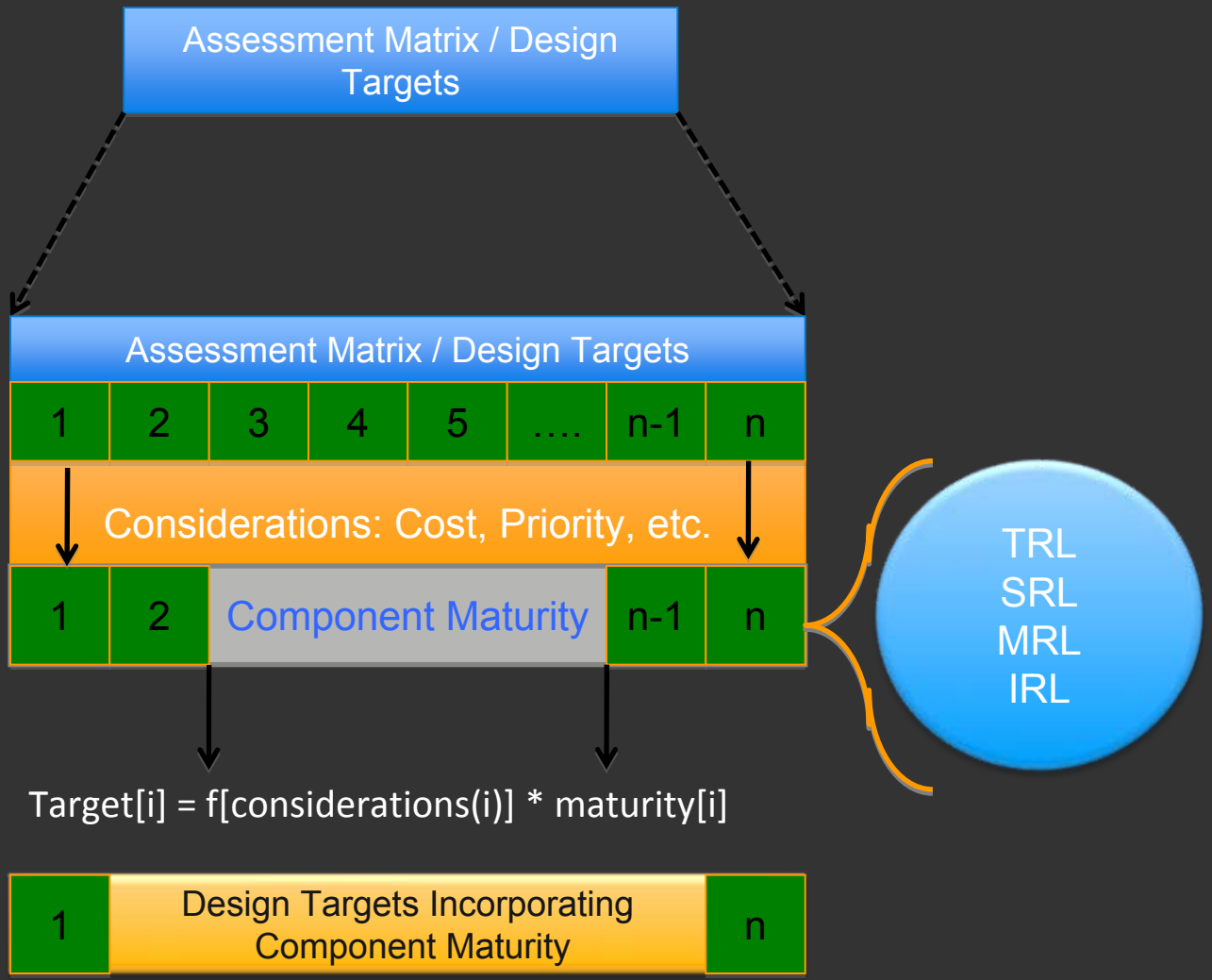
Proposed Solution

provide a process for maturity early in the acquisition life-cycle



Proposed Solution

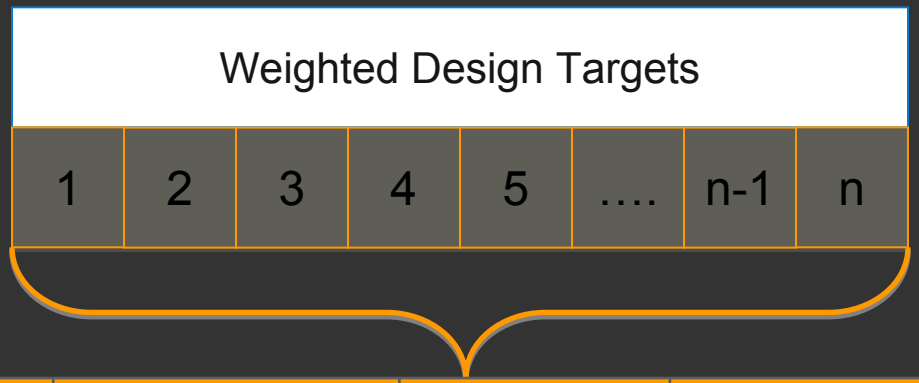
integration approach into House of Quality



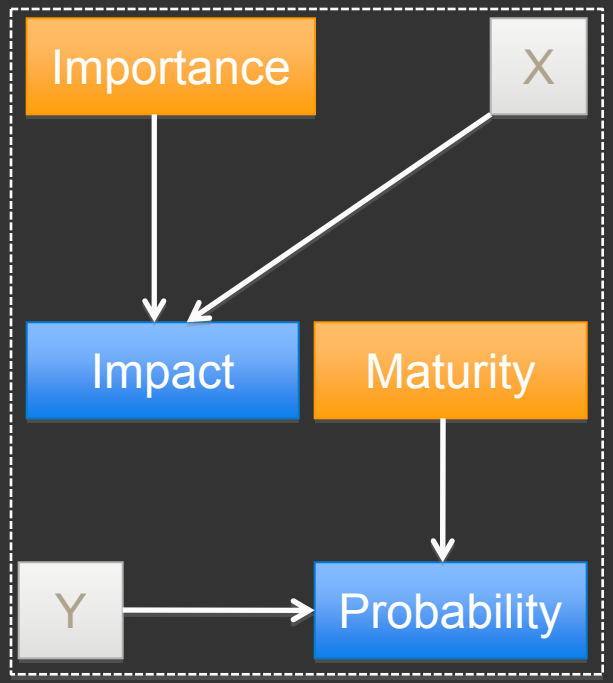
Integration Approach

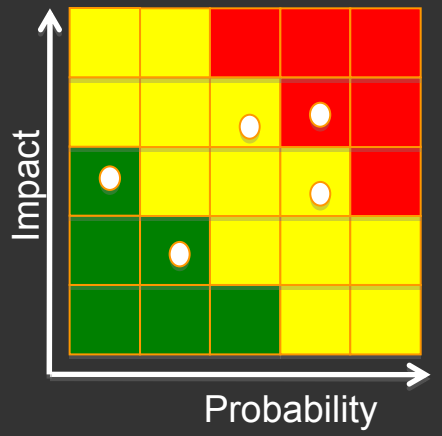
into the House of Quality

Target[i] = f[considerations(i)] * maturity[i]



1	Consideration	Maturity	Importance
2	Consideration 2	TRL 4	8
3	Consideration 3	TRL 2	7
…	Consideration 4	TRL 9	3
n	Consideration n	TRL 8	2



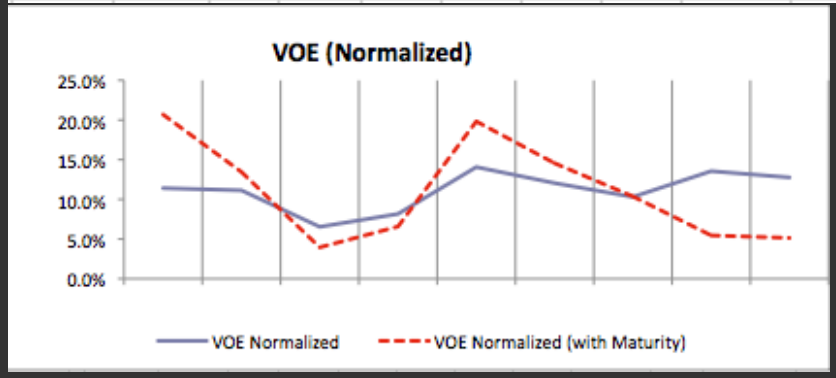


Academic

example

Voice of the Customer (VOC)	Importance	Engine	Single Speed Transmission	Suspension	Production Facilities	Component Redundancy	Advanced Safety Features	Interior Microfabrics	LightWeight Body Materials	Modern Material Selection (Composites,
		Voice of the Engineer (VoE)								
Efficiency (Gas Mileage)	7	9	7	3	1	6	2	1	9	6
Interior (Size, Comfort, Durability)	9	1	1	5	1	6	3	9	6	6
Exterior (Performance over Time / Appeal)	5	3	1	1	1	6	3	1	6	6
Performance (Power Ratio, Stability, Balance)	7	6	6	3	1	6	3	1	6	3
Safety Features (Airbags, ABS, Traction Control)	8	2	3	1	1	6	9	1	3	4
Status Perception (Image / Appeal)	4	6	3	3	1	1	2	3	6	4
Environmental Responsibility	7	6	6	1	9	6	4	6	6	5
Customization (Individualism)	8	1	2	1	6	3	1	3	1	3
Cutting Edge Features	7	3	6	2	1	3	9	6	1	4
Costs (Initial and Sustainment)	8	6	5	3	6	6	6	4	6	5
		4.1	4.0	2.4	2.9	5.1	4.3	3.7	4.9	4.6
		11.4%	11.1%	6.5%	8.2%	14.1%	12.0%	10.3%	13.6%	12.8%
		Removed For Simplicity								
		9	6	3	4	7	6	5	2	2
		37.0	24.1	7.1	11.8	35.5	26.1	18.6	9.8	9.2
		20.7%	13.5%	3.9%	6.6%	19.8%	14.6%	10.4%	5.5%	5.1%
		9.3%	2.3%	-2.6%	-1.6%	5.8%	2.5%	0.1%	-8.1%	-7.6%

VOE (Unscaled)
VOE (Normalized)
Manufacturing Readiness
Integration Readiness
System Readiness
Maturity Assessment (via TRL)
Weighed Maturity
VOE (Normalized with Maturity)
Impact



Conclusion

expected benefits

Incorporating component maturity assessment into the House of Quality is a disciplined approach for addressing maturity associated risk in complex system acquisition.

For a complete list of references and citations, please view the associated conference paper.