International Council on Systems Engineering
A better world through a systems approach

Value Methodology as Enabler for Architectural Definition: A Case Study in Product Development

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Presenters

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20-year experience in managing complex customer projects and development programs to tackle energy challenges.
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Principal Engineer for Value Methodology
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25-year experience in Cost Engineering and Value Methodology. In the last years she specialized in applying the methodology to product and technology innovation.
She holds SAVE and AACE certifications.

Gregorio Vettori

SE Digital Transformation Leader
Industrial & Energy Technology
Baker Hughes

Over 10 years of experience implementing software solutions to foster digital transformation into engineering organizations.
He is a CSEP since 2024.

Baker Hughes

~57,000
Employees

$27.8B
Revenues in 2024

$643M
R&D spend in 2024

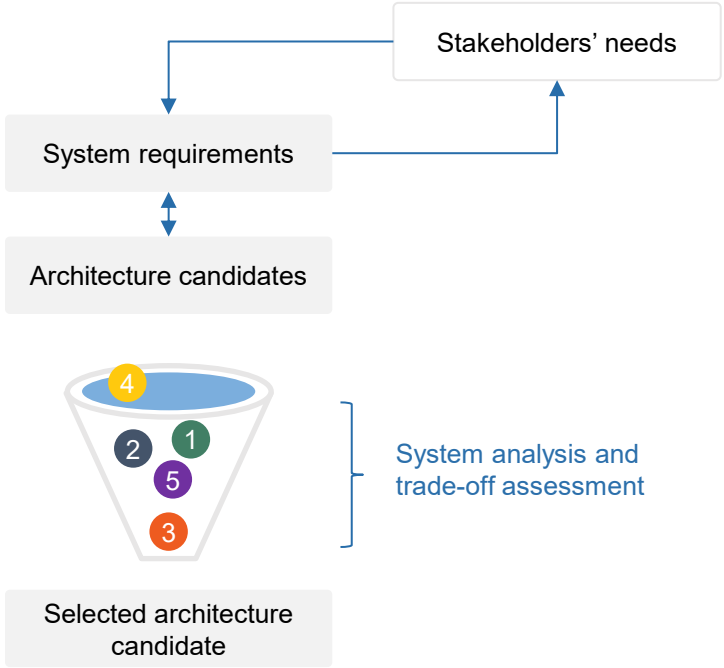
56
CSEP to date

We are Baker Hughes, an energy technology company. Together, we're making energy safer, cleaner, and more efficient for people and the planet.

Baker Hughes has a diverse portfolio of technologies & services across the energy landscape, providing equipment & solutions to help solve the world's greatest energy challenges.

In a context of growing energy demand, we need to rethink our products, conceiving innovative alternatives and incorporating emerging technologies effectively, whilst matching the constraints of an established industrial landscape.

Approach to architecture definition



Process driven

Tailored implementation of ISO/IEC/IEEE 15288, ISO/IEC/IEEE 42010 and SE best practices.

Legacy driven

Center of excellence for turbo-machinery applied to the energy and industrial sectors with over 180 years of experience

Performance driven

Prescriptive performance requirements as architecture constraints

Value methodology 101

Value Methodology

Definition

A systematic process used by a multidisciplinary team to improve the value of a system through the analysis of its functions.

Legacy

- 1940's: General Electric (GE) began substituting alternative materials for products due to shortages caused by WWII, with the challenge not to degrade the required performance parameters.
- 1947: Larry Miles developed the cost reduction concepts applied in the GE purchasing department. The approach, named Value Analysis, allowed the user to concentrate on function requirements
- 1950's: Approach adopted by US federal government agencies. The Society of American Value Engineering (SAVE) was formed in 1959.

References

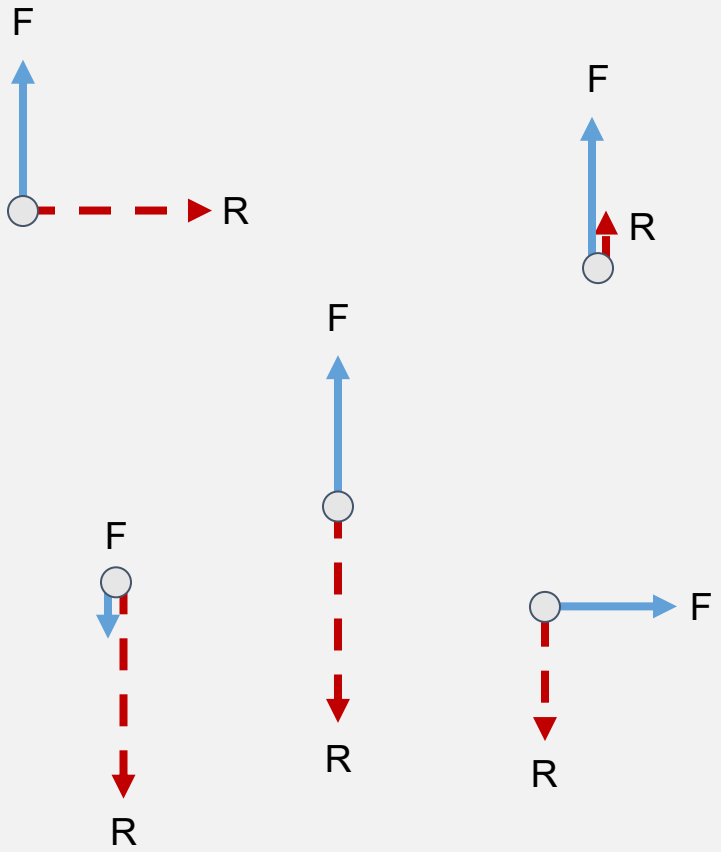
- SAVE International https://www.value-eng.org/
- ASTM E1699-14 - Standard Practice for Performing Value Engineering (VE)/Value Analysis (VA) of Projects, Products and Processes
- EN 12973 – Value management

Defining Value

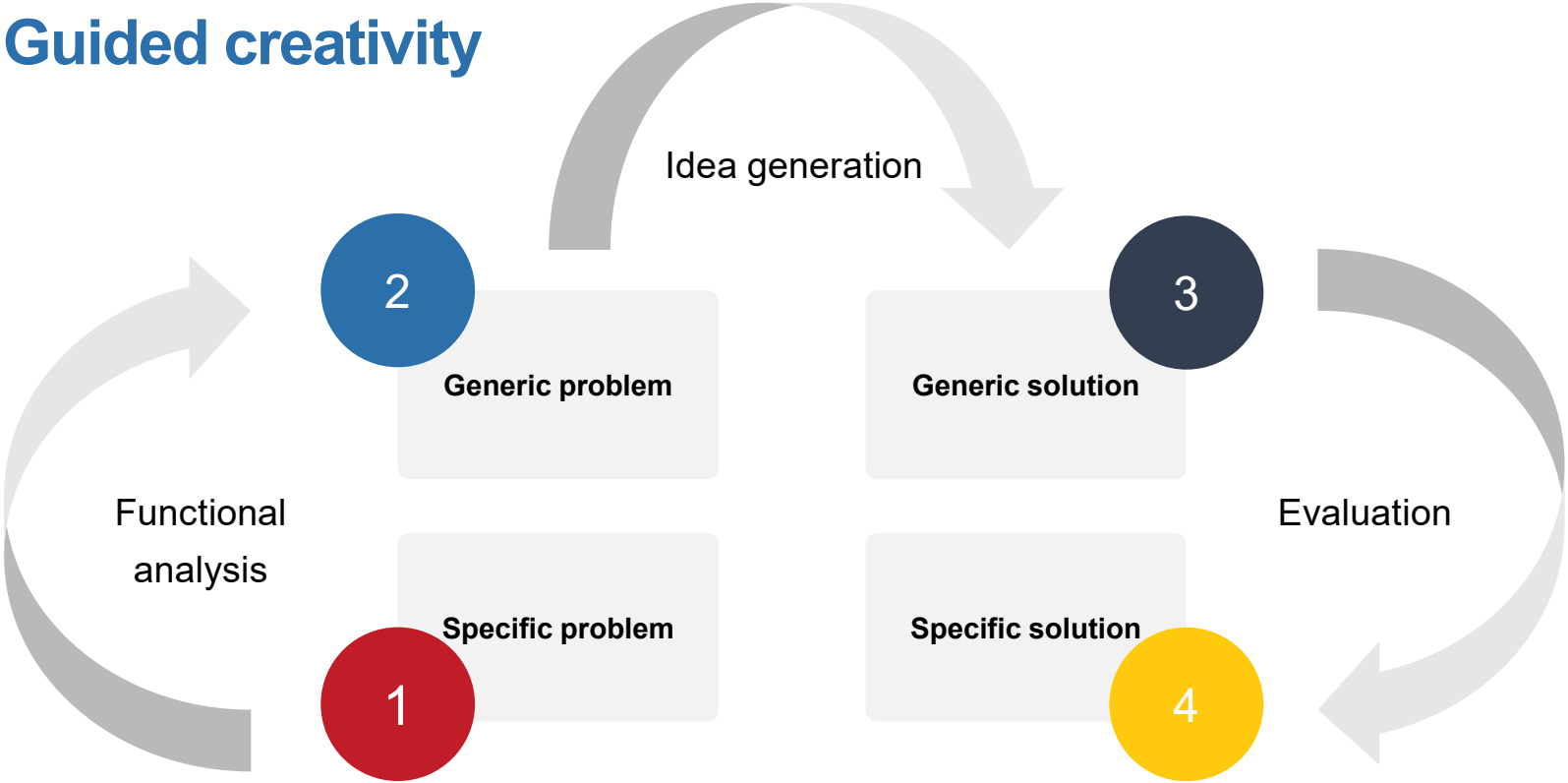
$$VALUE = \frac{Function}{Resources}$$

Value is an expression of the relationship between performance and resources; outputs and inputs; or benefits and costs in satisfying a function.

Different models can be applied to improve the value of a system.

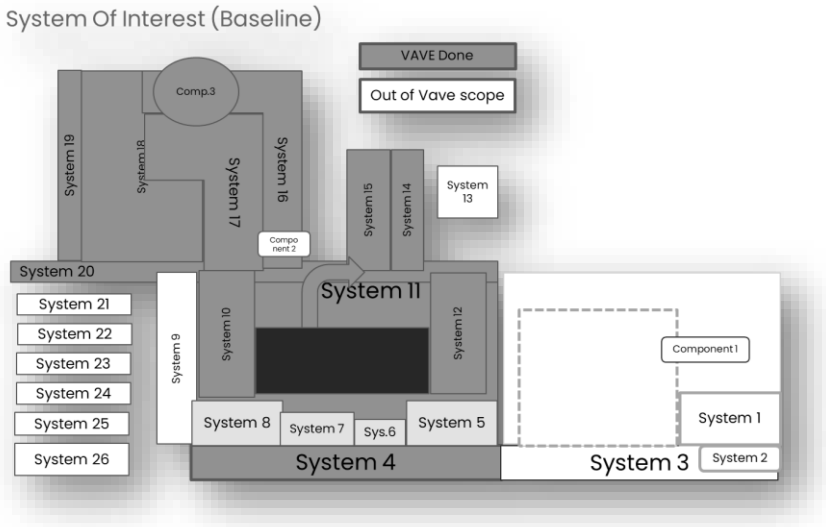


Guided creativity



Case study: value methodology applied to architecture definition

Value methodology applied to machinery HVAC system…

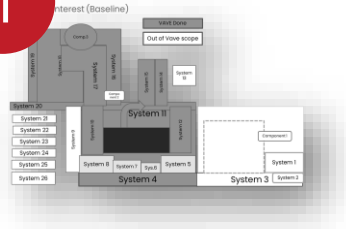


Functional analysis

Rank	Function	%
1	deliver fluid	60%
2	resist corrosion	
3	contain parts	
4	improve dependability	
5	reduce noise	
6	sustain weight	

…enabling alternative architecture candidates

1



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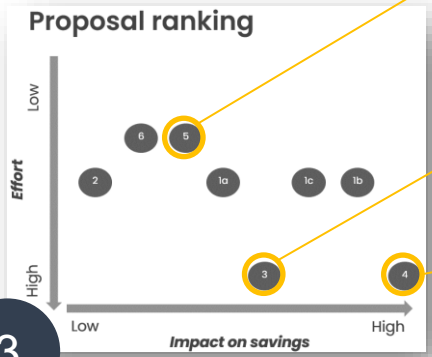
	Function	%
1	deliver fluid	
2	resist corrosion	
3	contain parts	60%
4	improve dependability	
5	reduce noise	
6	sustain weight	

- ✓ Functional analysis applied to complete SOI (i.e., multiple elements and interfaces).
- ✓ "Sprint" approach leveraging team expertise to generate architecture candidates.
- ✓ Capture additional ideas applicable to system design and implementation.

3



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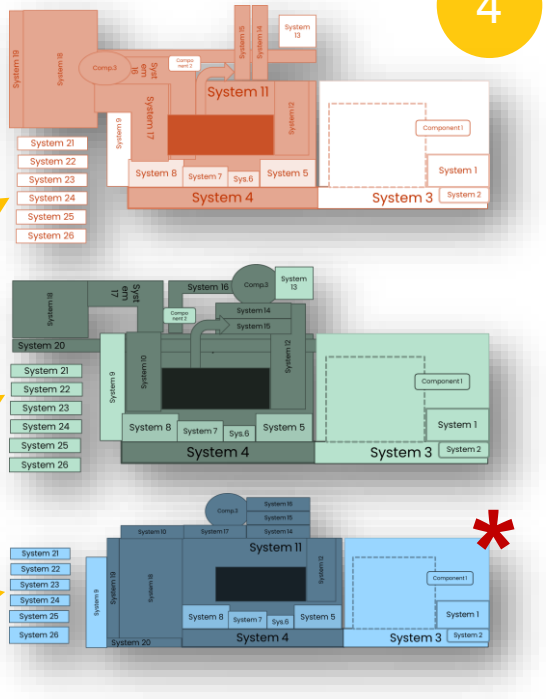

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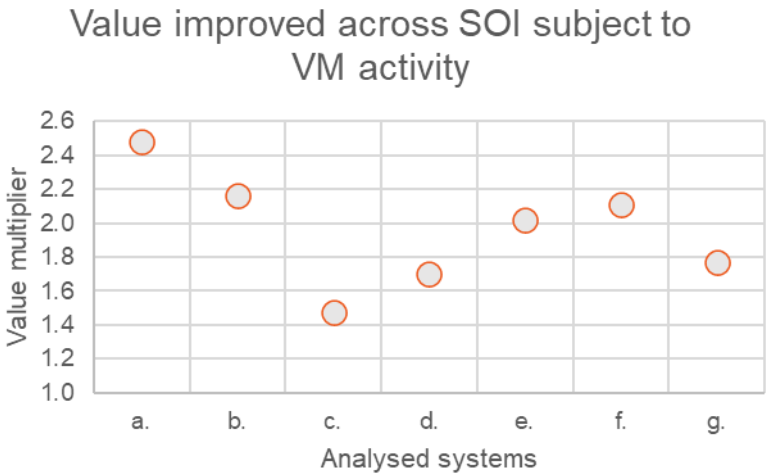
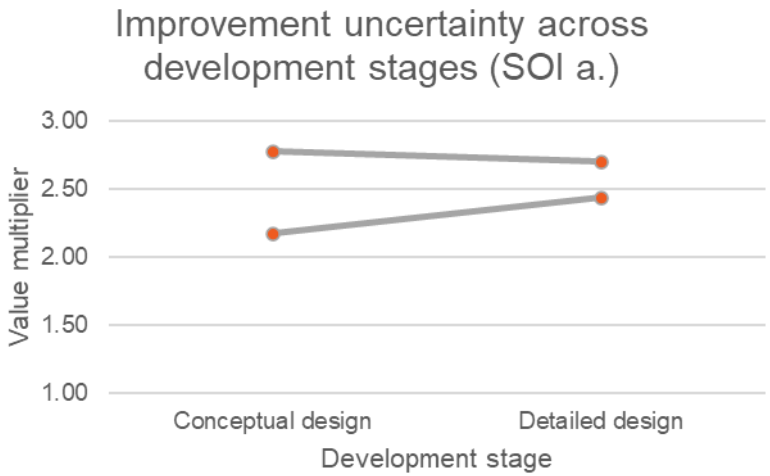
** Following VM workshop, the different architecture candidates are assessed against stakeholders' requirements and selected candidate proceeds through conceptual design*

Systematic approach yields systematic results





a. Fluid system
b. Control panels
c. HVAC system
d. Structural equipment
e. BoP (mechanical)
f. BoP (electrical)
g. Process module

Success factors





Preparation

- Problem statement: scope, baseline, and need
- Data driven

Workshop

- Focused and time-bound
- Expert facilitator
- Systematic methodology

Team

- Expertise
- Diversity
- Full life cycle

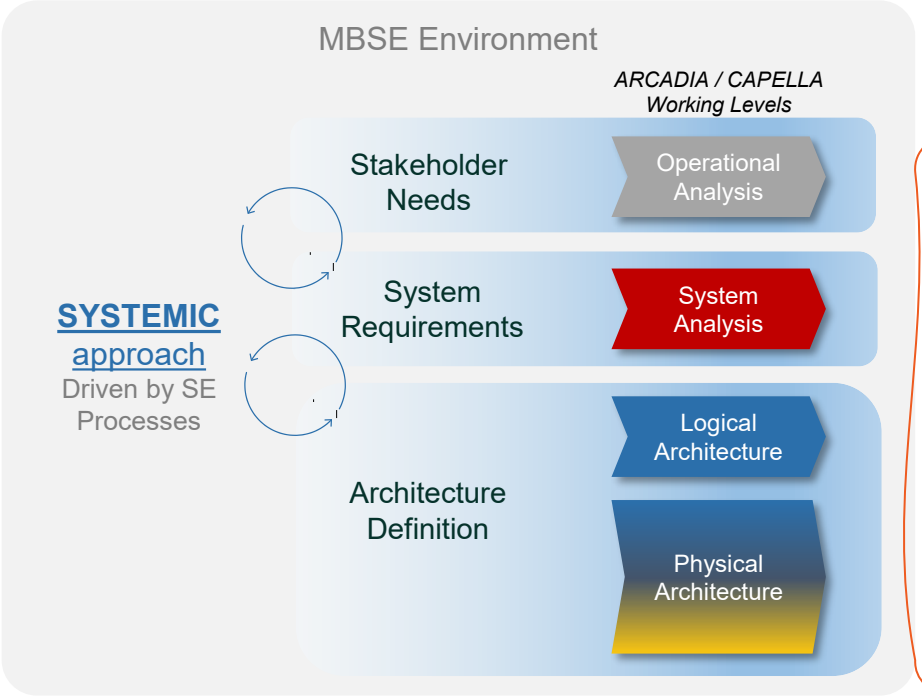
Ground rules

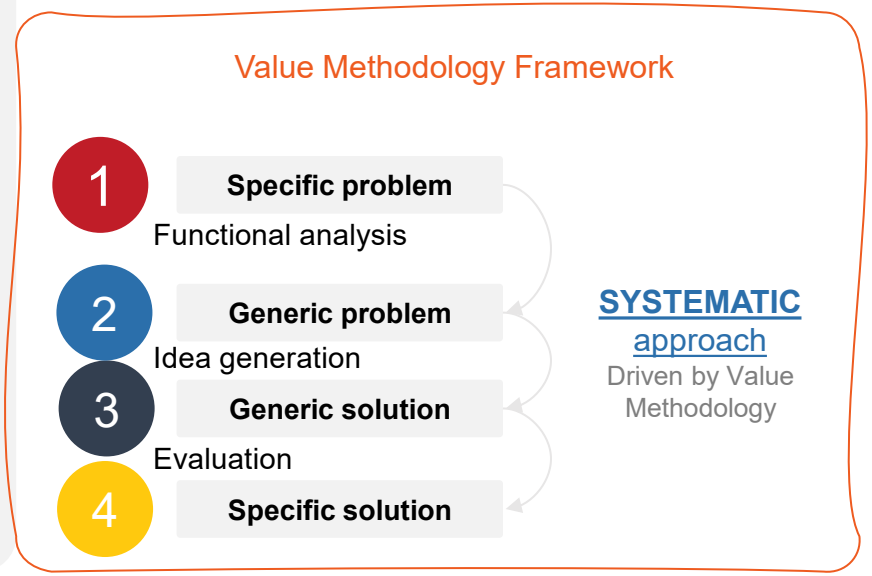
- Don’t judge
- Challenge the status quo

Framework

- Integration with company product development process
- Follow-up on implementation

Opportunity: MBSE+VAVE





Conclusions

- Value methodology provides a structured framework for definition of innovative architecture candidates
- Application is agnostic to environment and system
- Workshop format promotes team engagement and cross-functional involvement
- Integration with overarching development process enables systematic benefits
- Opportunity to embed into MBSE workflow

Thank you!

35th Annual INCOSE international symposium

hybrid event

Ottawa, Canada
July 26 - 31, 2025