WPI

Policy Content Modeling Framework and Process for Engineered Systems

Dr. Shamsnaz Virani Bhada
Assistant Professor
Systems Engineering

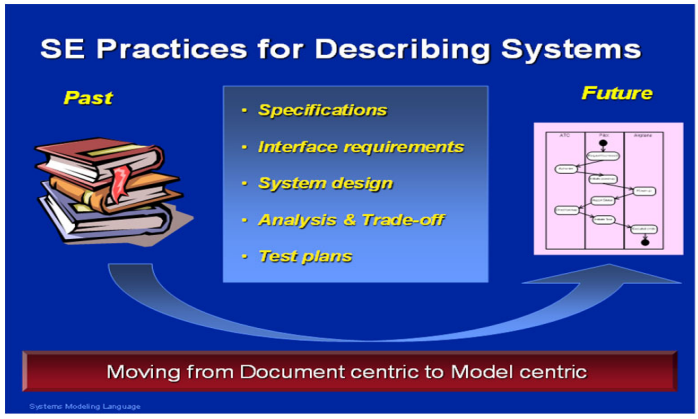
Agenda

- Why Model?
- Why did we model?
- What has been done before?
- What we did
- Our Results
- Future Research Areas

Why Model?

Why Systems Engineers Model

- **Reduce -**
  - Ambiguity,
  - Vagueness,
  - Complexity,
  - Omission,
  - Duplication,
  - Wordiness,
  - Inappropriateness
- **Increase -**
  - Clarity
  - Simplicity
  - Understanding
  - Communication
  - **Analytics**



Why Model Policy

Reduce
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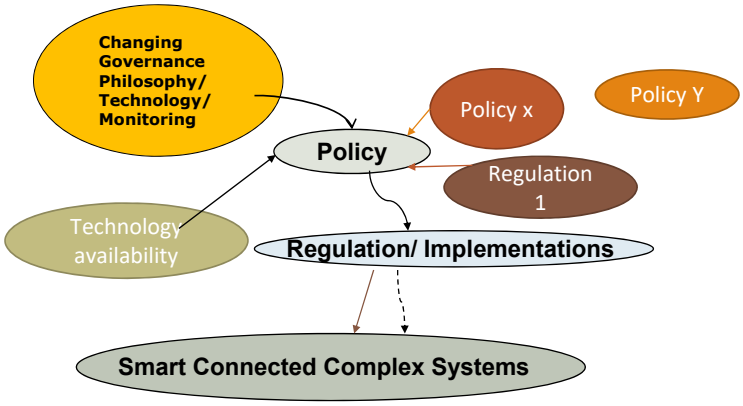


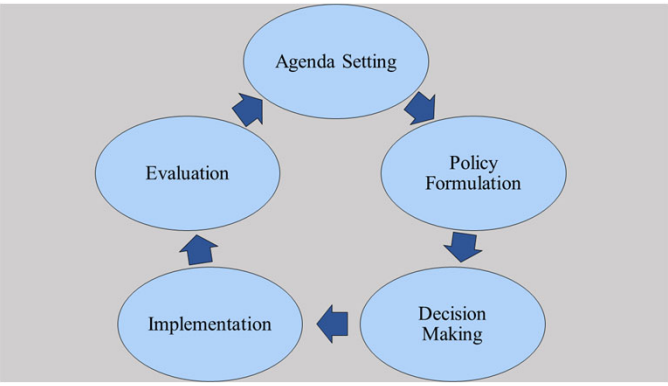
Why did we model?

What GAO Found

To determine which federal government programs and functions should be designated high risk, GAO considers a number of factors. For example, it assesses whether the risk involves public health or safety, service delivery, national security, national defense, economic growth, or privacy or citizens' rights, or whether the risk could result in significantly impaired service, program failure, injury or loss of life, or significantly reduced economy, efficiency, or effectiveness. There are five criteria for removal from the High Risk List: leadership commitment, capacity (people and resources needed to resolve the risk), development of an action plan, monitoring, and demonstrated progress in resolving the risk.

In designating the health care system of the Department of Veterans Affairs (VA) as a high-risk area, GAO categorized its concerns about VA's ability to ensure the timeliness, cost-effectiveness, quality, and safety of veterans' health care, into five broad areas:

1. **Ambiguous policies and inconsistent processes**. GAO found ambiguous VA policies lead to inconsistency in the way its facilities carry out processes at the local level, which may pose risks for veterans' access to VA health care, or for the quality and safety of VA health care.
2. **Inadequate oversight and accountability**. GAO found weaknesses in VA's ability to hold its health care facilities accountable and ensure that identified problems are resolved in a timely and appropriate manner.
3. **Information technology challenges**. Of particular concern is the outdated, inefficient nature of certain systems, along with a lack of system interoperability.
4. **Inadequate training for VA staff**. GAO has identified gaps in VA training that could put the quality and safety of veterans' health at risk or training requirements that were particularly burdensome to complete.
5. **Unclear resource needs and allocation priorities**. GAO has found gaps in the availability of data required by VA to efficiently identify resource needs and to ensure that resources are effectively allocated across the VA health care system.



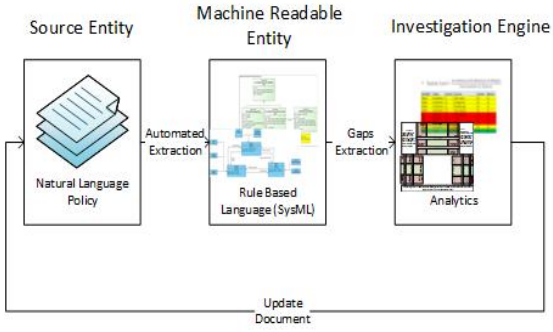
Generic Policy Cycle

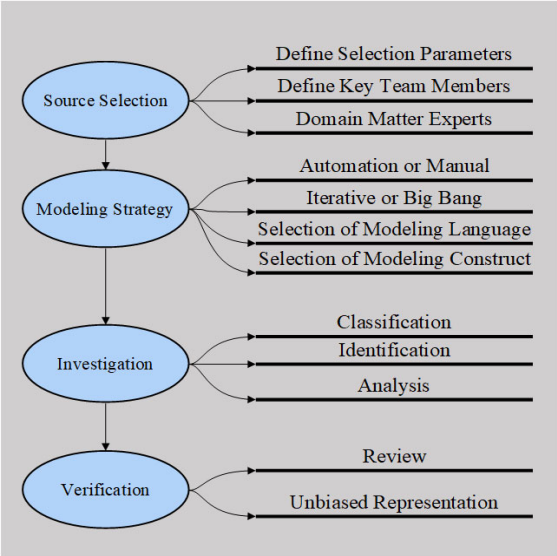
What we did: Investigation

- VA Policy Process
  - Editorial review
  - Peer review
  - Sent to central office for final evaluation
- Issue –
  - Policy making process is not well documente
  - No formal analysis method
  - In contrast to the Department of Defense
    - DoD ISSUANCE STANDARDS

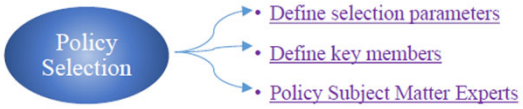
Hmm… so nothing like requirements in Systems Engineering
Can we replicated it?
What will we need

What we did :
Policy Content Modeling Framework and Process



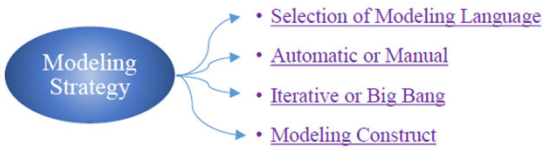


Our Results: Policy Selection



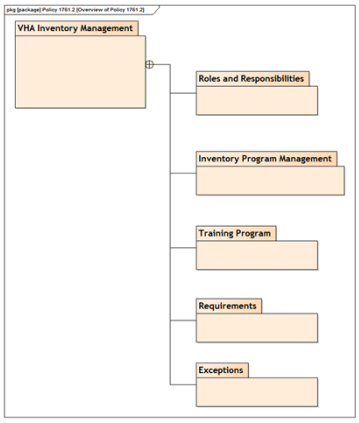
- Selection parameters
  - 4 policies provided by VA
- Key members
  - Research team at WPI
  - Veterans Engineering Resource Center (VERC)
- Policy Subject Matter Experts
  - VERC

Our Results: Modeling Strategy

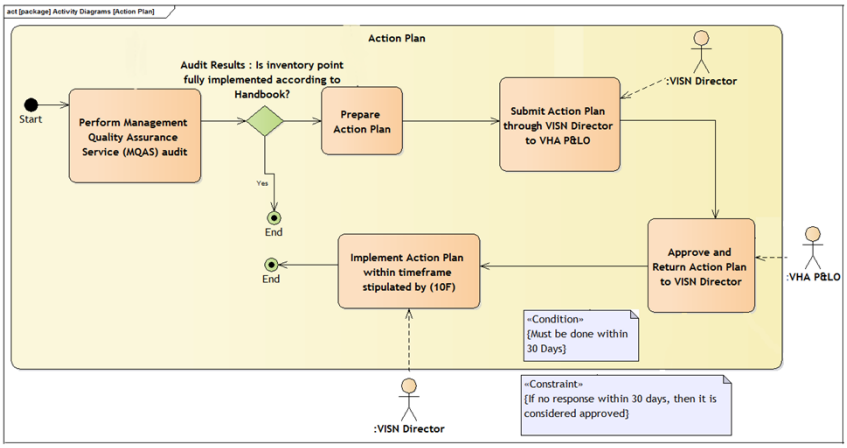


- Modeling language
  - SysML
- Manual and Some Automation
- Iterative
- Modeling Construct
  - Structural and Behavioral diagrams

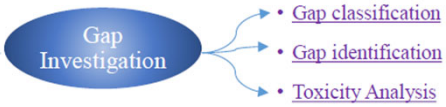
Our Results: Structural Diagram



Our Results: Behavioral Diagrams



Our Results: Analytics

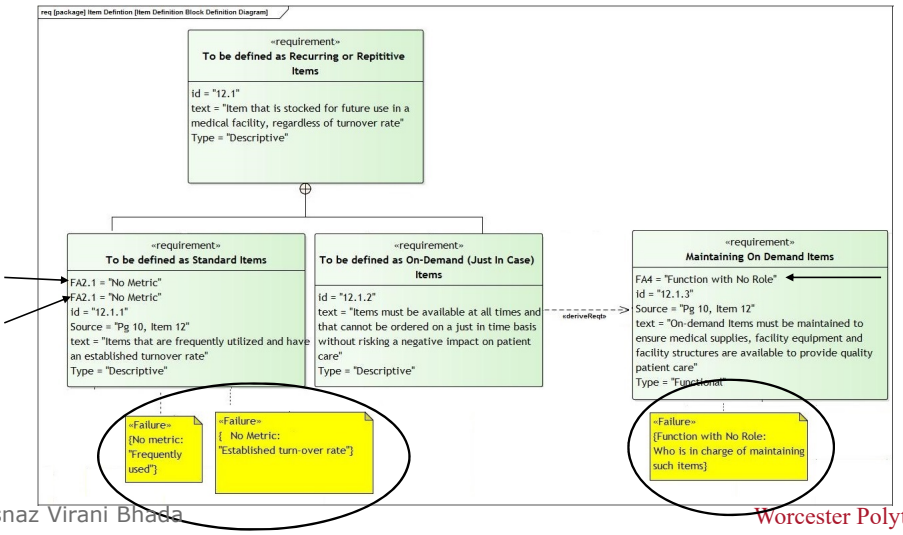


- Gap Classification

Gap Code	Gap Name	Gap Weight	Property	S	B
1	Role with no function	Medium	Incompleteness	Yes	Yes
2.1	Response required without metric	Medium	Incompleteness	Yes	Yes
2.2	Response required without verification	Medium	Incompleteness	Yes	Yes
3.1	No trigger event	Medium	Incompleteness	No	Yes
3.2	Misplaced trigger	Medium	Incompleteness	No	Yes
3.3	Gaps in sequence	Medium	Incompleteness	No	Yes
3.4.1	Conflicting time target	High	Inconsistent	Yes	Yes
3.4.2	Conflicting role target	High	Inconsistent	Yes	Yes
3.4.3	Requirement	Low	Inconsistent	Yes	Yes
4	Function with no role	Medium	Incompleteness	No	Yes
5	Unnecessary words	Low	Verbosity	Yes	No
6	Vague language	Low	Ambiguity	Yes	No
7	Undefined term	Medium	Ambiguity	Yes	No
8	Ref. other document	Low	Reference	Yes	No
9	Redundancy	Low	Verbosity	Yes	No
10	Misplaced information	Low	Inconsistent	Yes	No
11	Role not listed	Medium	Inconsistent	Yes	No

S - Structure, B - Behavior.

Our Results: Analytics



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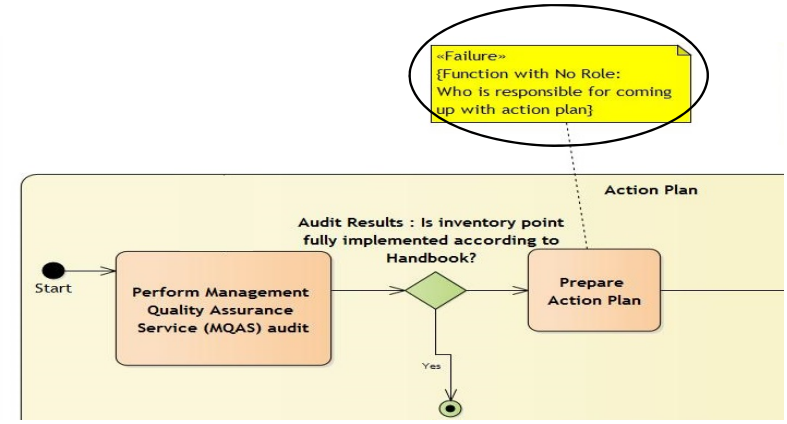

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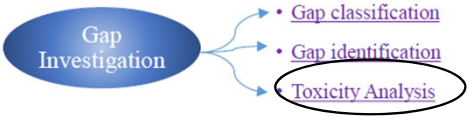


$$Policy\ Toxicity = \frac{\sum_{i=1}^{T} \propto_i n_i}{N}$$

Where T is the number of weight-levels for gaps, is the weighting factor, n is the number of gaps of a given weight level, and N is the normalization factor.

Our Results: Analytics

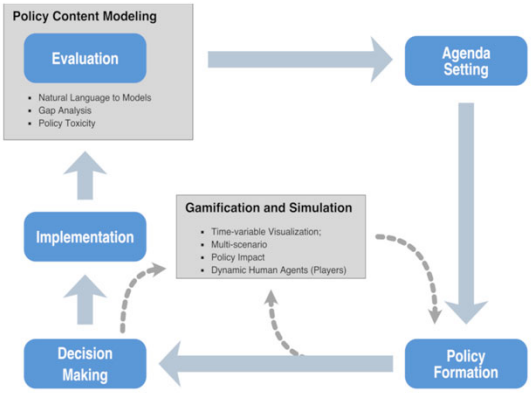
Policy	1761.01	1761.02	7002	Directive 7002
Total number of pages (N)	21	30	132	20
High gaps (n_3)	8	18	13	7
Medium gaps (n_2)	21	46	14	20
Low gaps (n_1)	43	37	34	42
Policy Toxicity	0.9000	1.0067	0.1326	0.8950

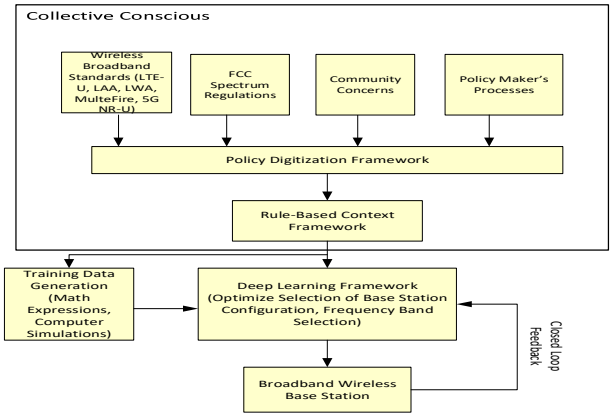
GAP TRACE

Gap Tagged Value	Description
Gap Code	3.4.2
Description	Two goals for the same target requirement
Source	Frequency of meetings
Source Type	Requirement
Text Source	Ch. 6b, p. 5
Gap weight	3
Policy	1761.1

Our Results: Model Checking

- Model Review
  - With Subject Matter Experts from VERC
  - Only partially unbiased
- Ideal scenario
  - Model review and acceptance from entire department





Future Work

- Automation
- Analytics
- Evolution

https://wp.wpi.edu/smerl/
https://ieeexplore.ieee.org/abstract/document/9136882

Questions?