THE GEORGE WASHINGTON UNIVERSITY
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Systems Thinking Approach to Modernization and Maintenance of Aging Inland Waterways Infrastructures

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Problem Statement

- **BLUF: Current practices are not effective at increasing the utility of the system as a whole.**
- Lack of M&M of the aging inland waterways infrastructure create a danger for losing this important asset ultimately causing disruptions on transportation services, flood management, water and power supplies, and wildlife.
- Expert judgement provides subjective results
- Decisions strictly tied to economic constraints, seeking short term solutions
- Solutions considered at regional level thus not providing systems level solution

Current Practices

5X5 Relative Matrix

Capture the risk of failure on a 5X5 relative risk matrix cube

Operational Condition Assessment

An effort to separate mission critical assets from non-mission critical ones and assess conditions

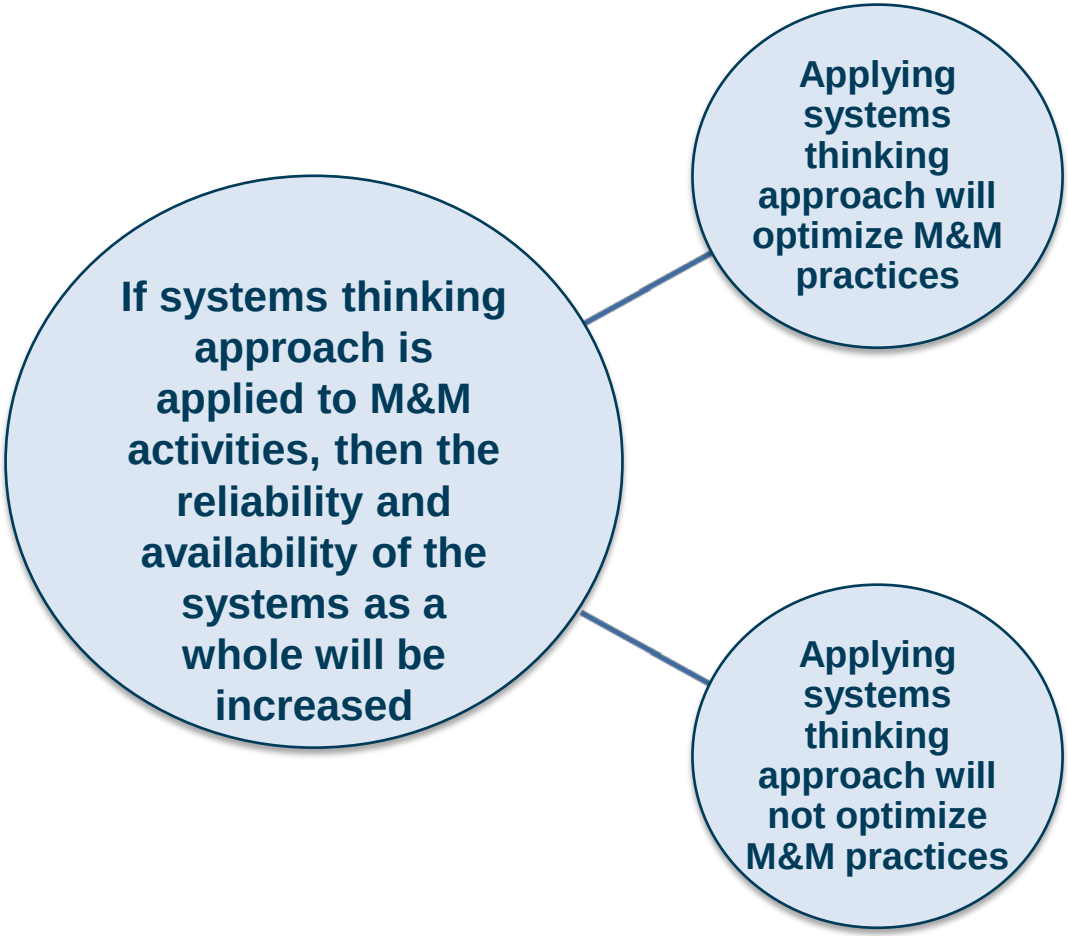
Asset Management

OCA at a regional level started using economic impact rather than tonnage for the consequence on the 5X5 risk matrix cube

Asset Management Portfolio Analytics

Prioritize resource's failure and economic consequence at a regional level

Hypothesis

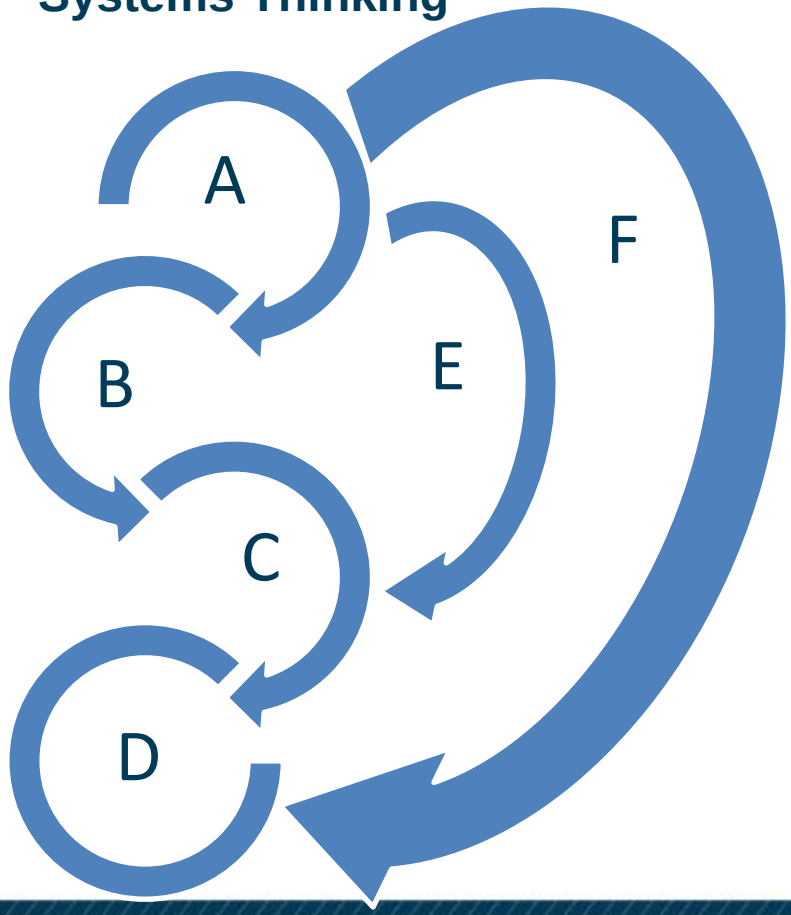

If systems thinking approach is applied to M&M activities, then the reliability and availability of the systems as a whole will be increased
Applying systems thinking approach will optimize M&M practices
Applying systems thinking approach will not optimize M&M practices

Systems Thinking Approach

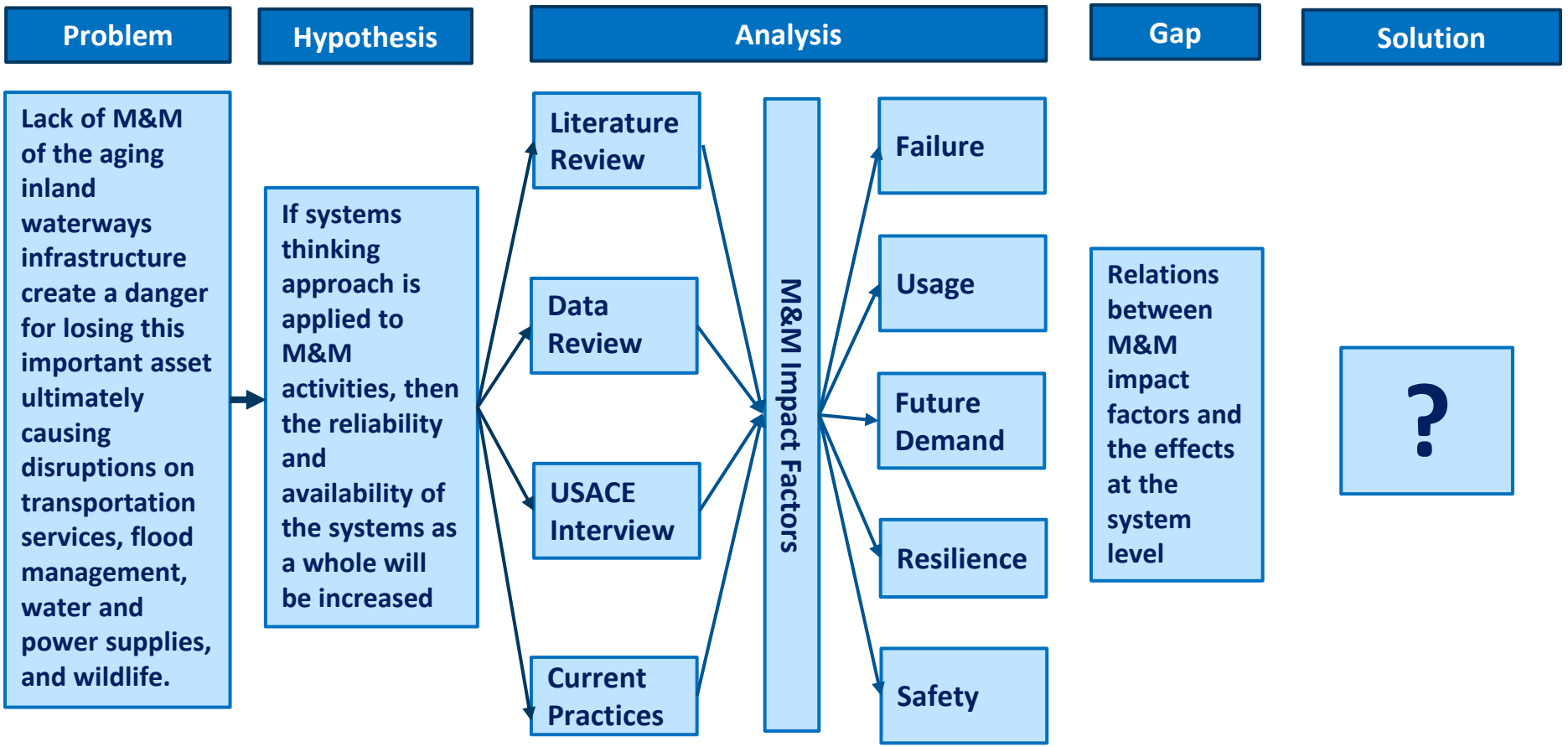
Linear Thinking

- Systems thinking is holistic view which promotes innovative thinking
- Analyze the system as a whole and understand the interrelationships between components of the system to create a long-term solution

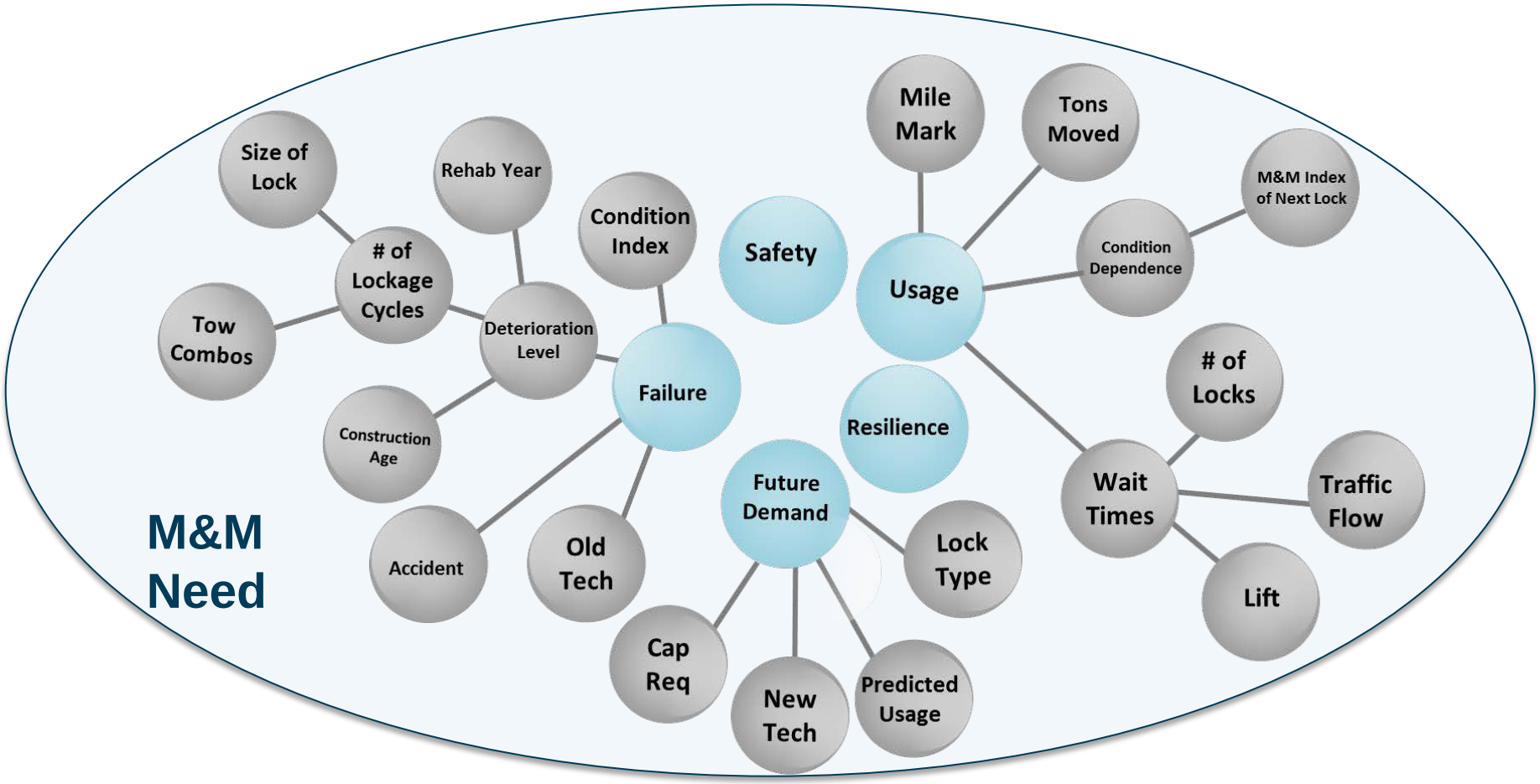
Systems Thinking



Research Framework



Impact Factors



Data Source

- Lock Performance Monitoring System
- Public data provided by USACE public data on
  - Number of vessels using a particular lock,
  - Lock type at each mile marker
  - Dates and number of lockage cycles
  - Vessel directions
  - Lock closure dates, durations and causes (scheduled or unscheduled)
- This data can be used to demonstrate interrelationships between impact factors

Summary

- Systems thinking approach considering all impacts of modernization and maintenance requirements will optimize decision making processes for asset management of aging infrastructures
- Further research is proposed to use systems thinking approach and stochastic modelling to optimize modernization and maintenance of aging infrastructures, and generate an unbiased assessment methodology

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Questions

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