Systems Thinking Approach to Modernization and Maintenance of Aging Inland Waterways Infrastructures

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Content

- Problem Statement
- Current Practices
- Hypothesis
- Systems Thinking Approach
- Research Framework
- Impact Factors
- Data Source
- Summary
- References
- Questions
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 is a 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.

Linear Thinking:

- A → B → C

Systems Thinking:

- A → C → E → F
- B → C
- D → C
- E → C
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.

If systems thinking approach is applied to M&M activities, then the reliability and availability of the systems as a whole will be increased.

Relations between M&M impact factors and the effects at the system level.
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.
References

Questions

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