Valuing Industrial Information: Making information pay its way

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Overview

- What is valuing industrial information [in an infrastructural context]?
- Why do it?
- How?
- Supply Chain Cases
- Infrastructural Cases

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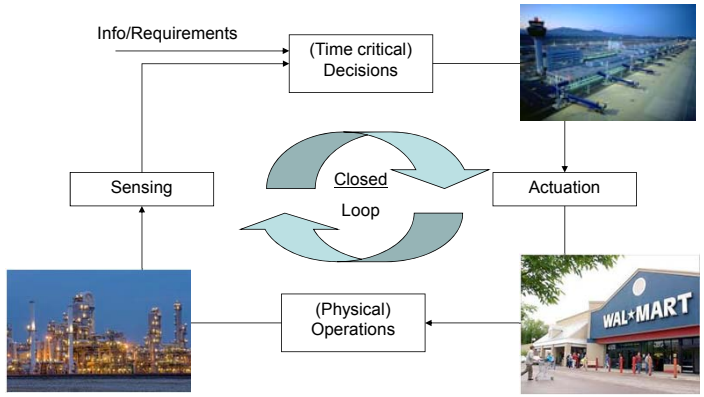
Using Industrial Information



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What is Valuing of [Industrial] Information?

The process of quantifying the impact that [improved] information has on decisions & actions that address a desired business issue

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The delivery of information of a required quality through appropriate technological routes

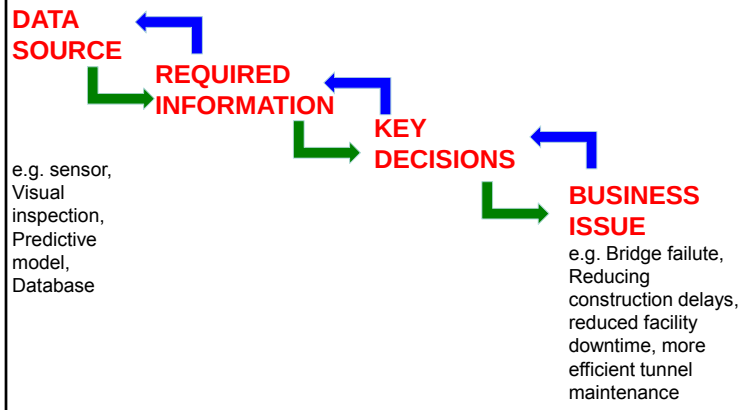
What is Valuing of [Industrial] Information?

Decisions

- Decisions & Information: role of information is to improve decisions
- Decisions influence ability to
  - Prevent failure
  - Maintain effectively
  - Operate reliably

Information

- Information quality is critical:
  - Timeliness
  - Accuracy
  - Completeness
  - Reliability
- IT: Information ≠ IT systems, sensors etc



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- What is valuing information [in an infrastructural context]?
- Why do it? Why formally value Information?
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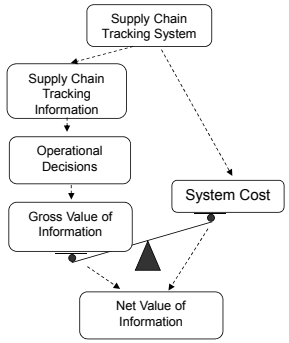
Why Value Information?

1. Information is not free. All useful information has a cost.
2. The benefit that new/improved information provides is often:
   - Unlcear
   - Uncertain
   - Probablistic
   - Misunderstood
3. Information without a decision has no use or value
4. Many different potential sources of information



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Why Value Information?

Should I invest in barcode or RFID for construction supply chain monitoring?

Is manual inspection as effective as automated sensing in a) structural failure detection/ prevention b) reducing maintenance costs?

Will an integrated information model provide benefits beyond labour cost savings?

Is a crack worth detecting?

Will 1,2,10,100 sensors be most appropriate for improving operational performance?

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How To Value Information?

VOI = Impact With Info – Impact Without

DATA SOURCE

7. Determine technological solution for providing information at appropriate level of quality

REQUIRED INFORMATION

5. Determine information critical to supporting key decisions.

6. Establish sensitivity of decision outcome to [quality of] each information variable

KEY DECISIONS

3. Identify key decisions critical to ensuring issue addressed

4. Clarify range of outcomes of key decisions

BUSINESS ISSUE

1. Clarify business issue(s) to be addressed

2. Estimate impact of "improvement" of issue [freq, cost, size]

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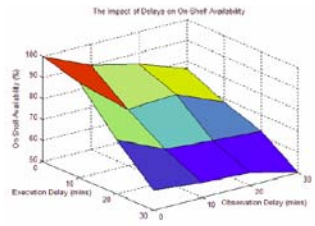
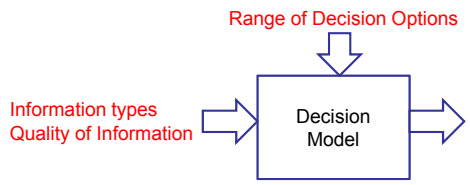
VoI tools: Impact Analysis

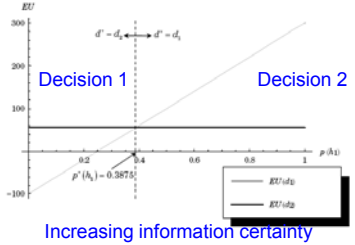
- Real options
- Fuzzy theory
- Heuristic Methods
- Scenario Planning
- Simulation
- Application specific tools
- …



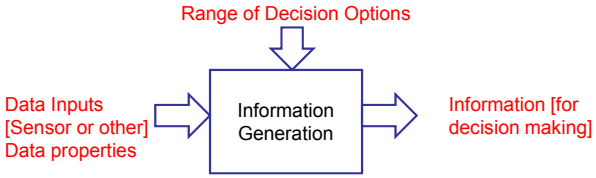
VoI tools: Decision Modelling



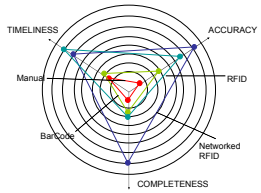
Many tools:
- Bayesian networks
- Hidden Markov Models
- Utility theory
- Decision trees
- Simulation
- …



VoI tools: Information Generation



Many tools:
- Signal processing
- Kalman Filtering
- Predictive modelling
- Quality analysis



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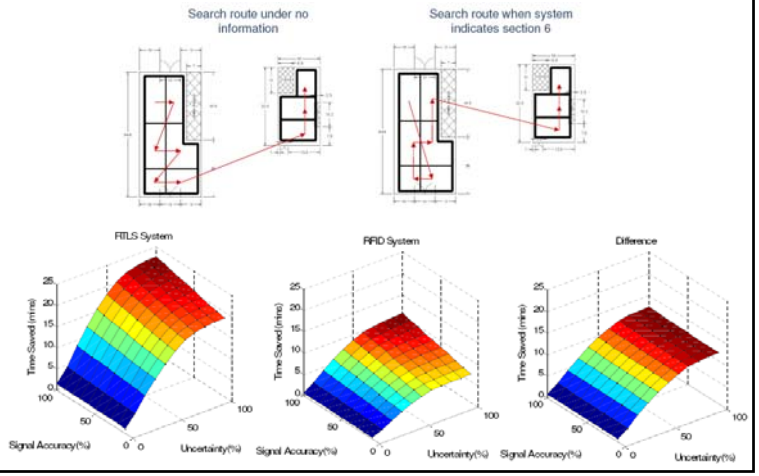
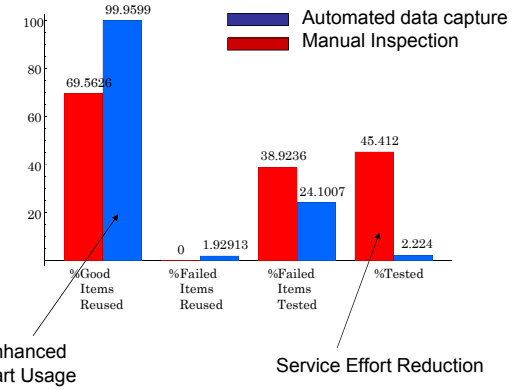
VoI for Tool Location Sensing decisions



VoI in Automotive Spare Parts Reuse

EXAMPLE:
Impact of AIDC
In automotive clutch recovery



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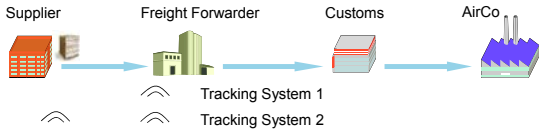
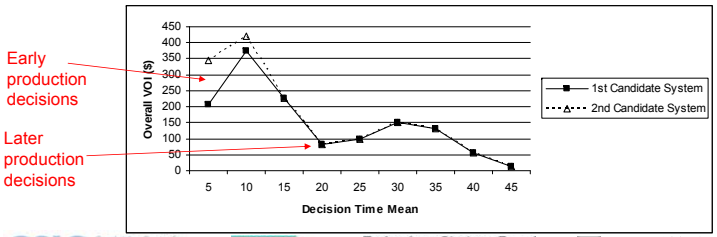
Value of Supply Tracking Information



Problem: AirCo seeking improved visibility of incoming shipments needs to select between two possible tracking system configurations



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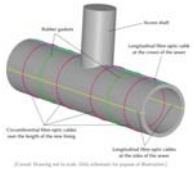
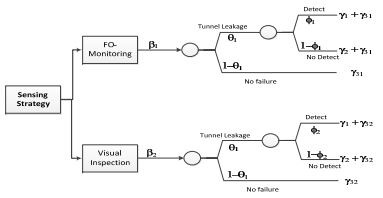
Value of Sensing in Tunnel Excavation Monitoring

- To monitor and to mitigate the risk of sewer damage, two monitoring strategies are considered
  - Visual Inspection
  - Fiber Optic Monitoring



Probability	Costs
θ_1= Pr(tunnel leakage)	γ_1= Repair cost
ϕ_1 = Pr(detect by FO | tunnel leakage)	γ_2 = Failure cost
ϕ_2 = Pr(detect by VI | tunnel leakage)	γ_{31} = Monitoring cost for FO
	γ_{32} = Monitoring cost for VI
	β_1 = Expected cost for FO
	β_2 = Expected cost for VI



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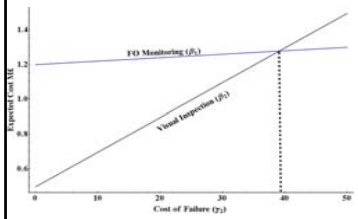
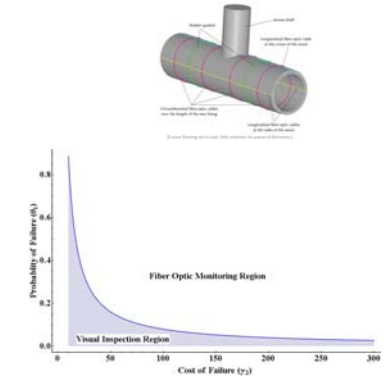
Value of Sensing: Tunnel Excavation Monitoring





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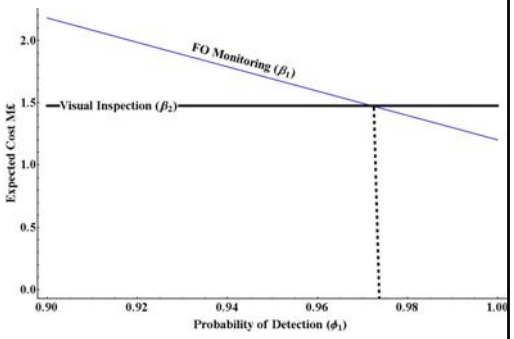
Value of Sensing:Tunnel Excavation Monitoring

- Minimal accuracy of the FO sensing should be greater than 97.5%
- Else, Visual inspection at 90% accuracy is preferable



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Summary

- Presented an approach to formally valuing information
- Beginning to examine infrastructural challenges
- Doesn't replace modelling, sensor development, data analysis!
- Closing loop on information is only way to get value from it

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