



Building Leadership Excellence



Optimal Quality Limits for On-line Measurements

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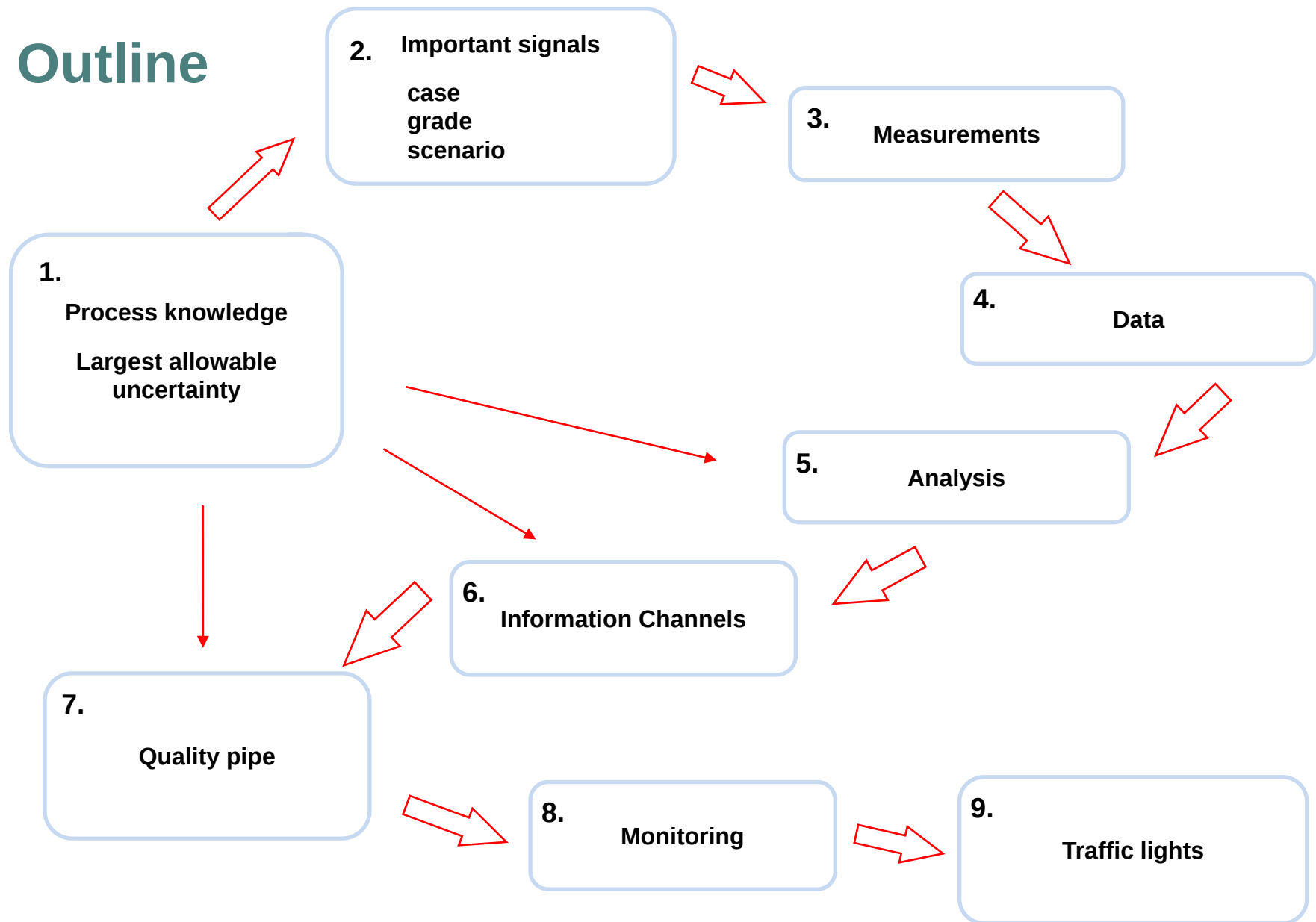
RETHINK PAPER:
Lean and Green

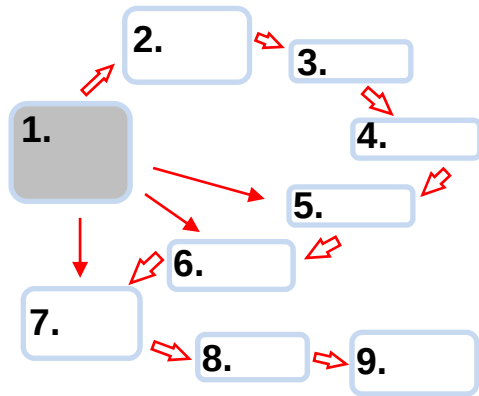
Introduction

- Every quality parameter has its acceptance limits set by the product specification.
- Motivation
 - Can we achieve more with the exploitation of measurement information and tacit knowledge?
 - Can the measurement resources be focused more efficiently to get current information more accurately and cost effectively or to get more information and gain better control over the process?
- Yes



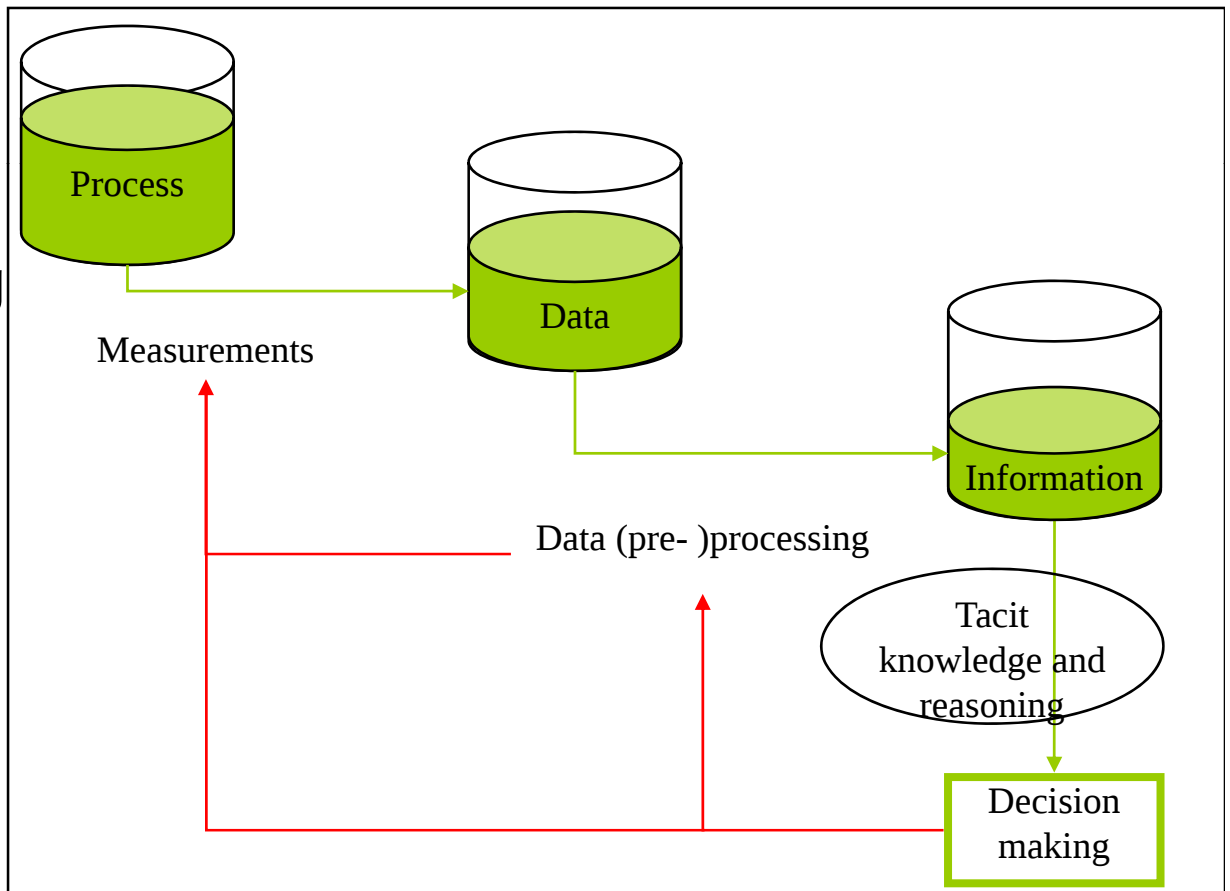
Outline

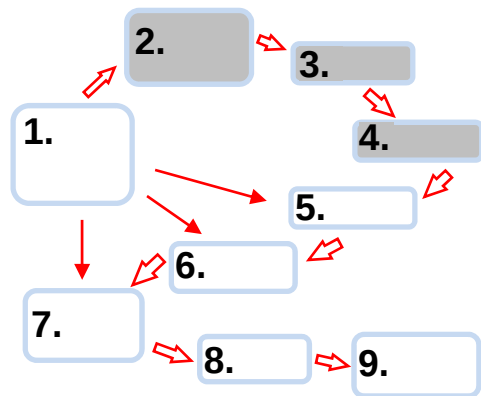




Process knowledge

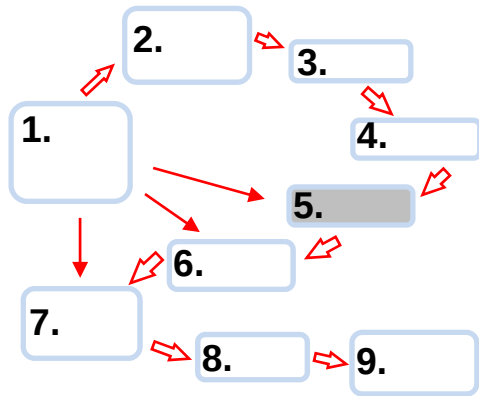
- Measurement policy
- Tacit knowledge
- Process of evaluating maximum allowed uncertainty
- Risk
- Understanding uncertainty





Measurements

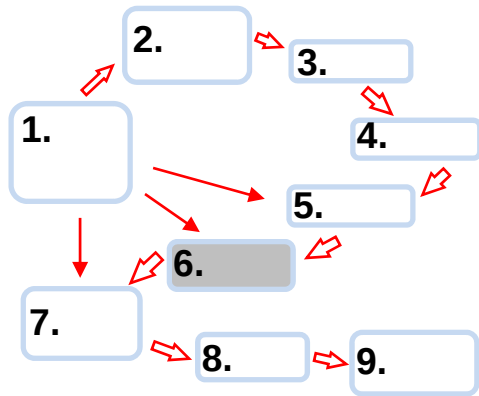
- Classification of signals
 - Case
 - Grade
 - Scenario
 - Uncertainty
- From measurement to data
 - Feedback-loop



Analysis

- Data analysis
- Quality model
 - Correlation analysis
 - Mutual information
 - Regression modelling
 - Stepwise





Information channels

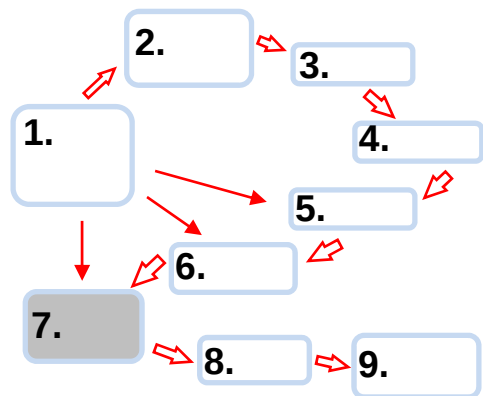
- Measurement knowledge
 - From each measurement, model or a priori
 - Measurement value
 - Uncertainty

$$f(x_{true} | x_1, \dots, x_j) = \frac{f(x_j | x_{true}) \dots f(x_1 | x_{true}) f_{ap}(x_{true})}{f(x_j) \dots f(x_1)}$$

$$\hat{x}_{ic_new} = \frac{\sum \frac{x_i}{\sigma_i^2}}{\sum \frac{1}{\sigma_i^2}}$$

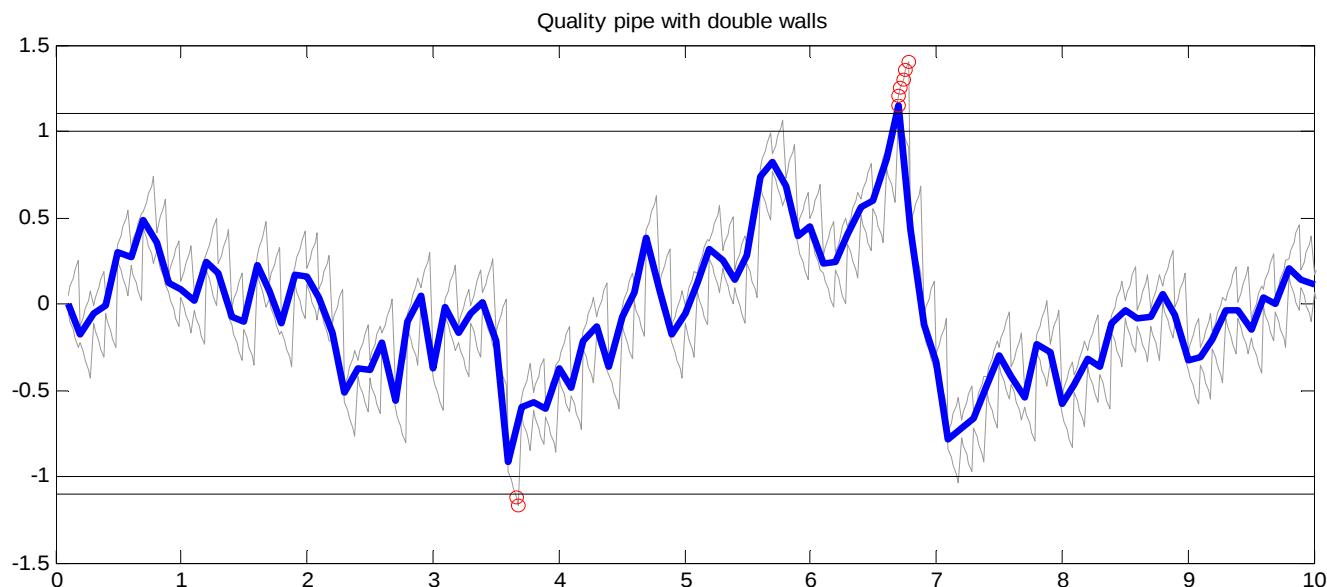
$$\hat{\sigma}_{ic_new}^2 = \frac{1}{\sum \frac{1}{\sigma_i^2}}$$

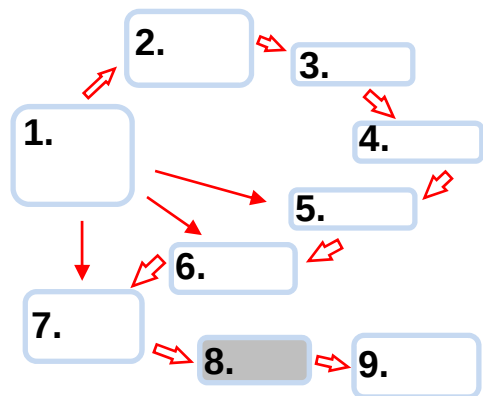




Quality pipe

- Double walls
 - Inner – signal
 - Outer - uncertainty

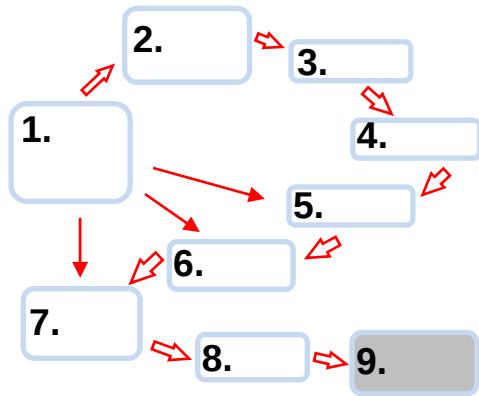




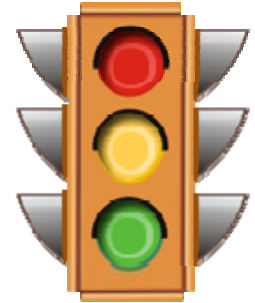
Monitoring

- SPC type monitoring
 - Six Sigma
 - Control charts
- Warning
- Metadata
 - Measurement knowledge
 - Optimization of measurements
 - Process improvements

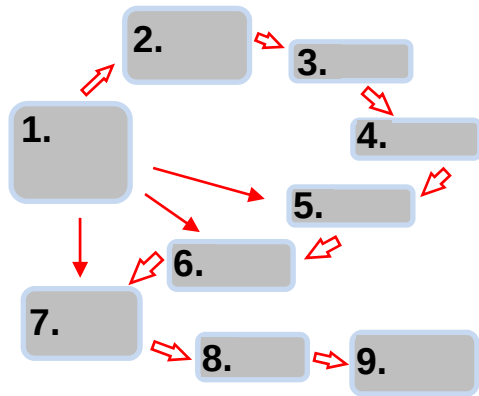




Traffic lights



- Combination of tacit knowledge and data analysis
- Visualisation
- Notification tool
 - Web feeding
 - Check list
 - Minimize human errors



Conclusions

- Process knowledge
- Data analysis
- Measurement knowledge
- Quality model
- Information channels
- Quality pipe

