ABOUT ME

RAMS SENIMAR

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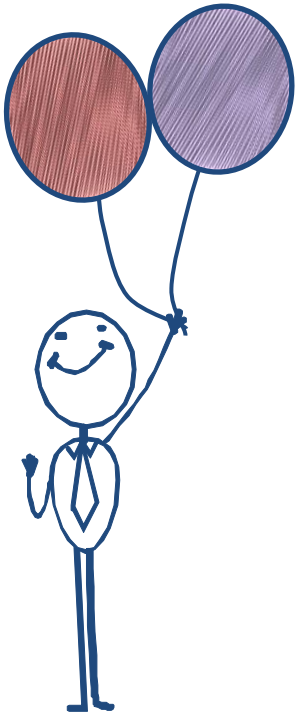
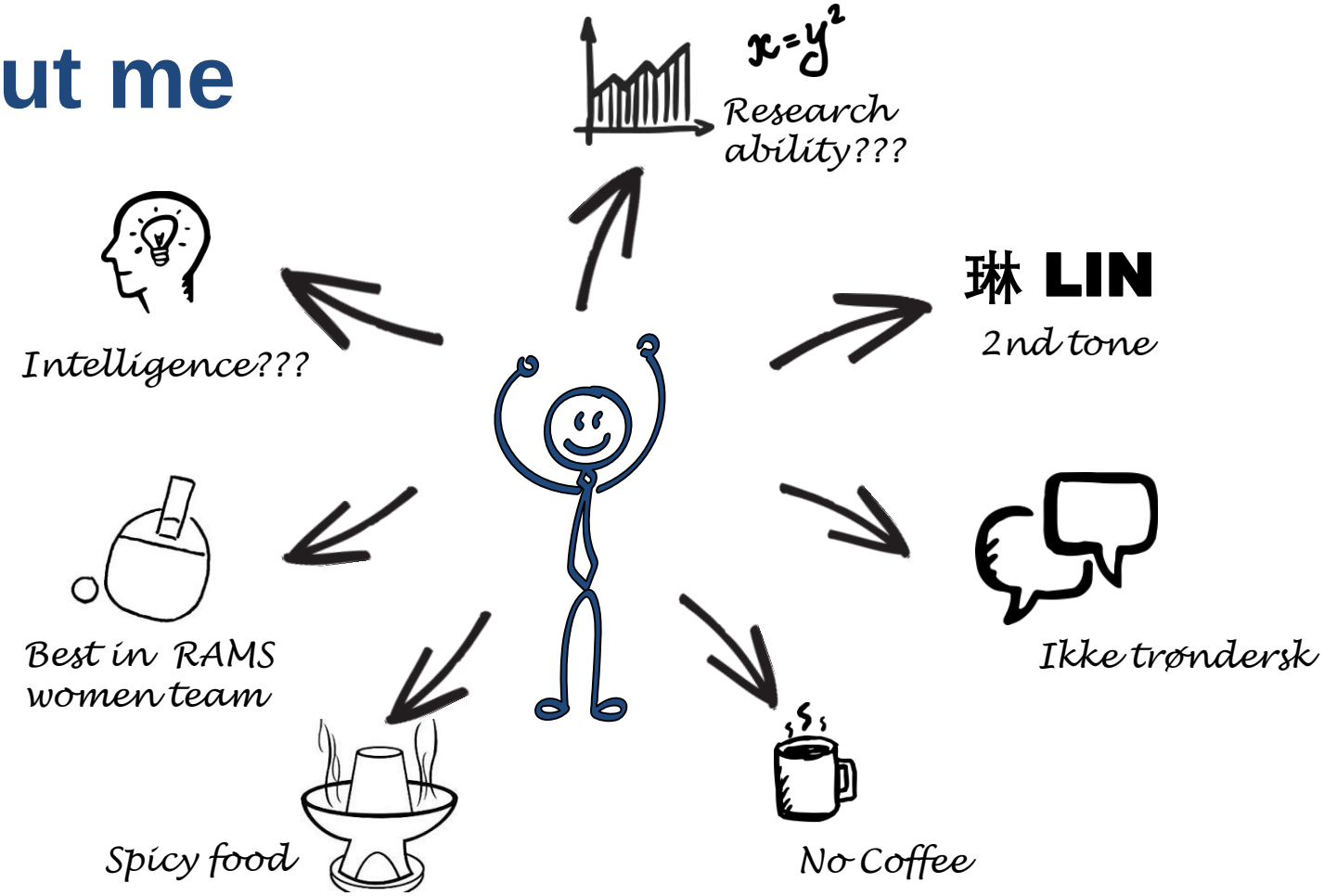
Norwegian University of Science and Technology

Content



1. Self introduction
2. Master project
3. PhD project

About me


$x=y^2$
Research ability???
Intelligence???
琳 LIN
2nd tone
Best in RAMS women team
Ikke trøndersk
Spicy food
No Coffee

Road to Norway

Beijing
Work as HR

Tianjing
M.E.
Management

B.E.
Traffic Engineer

Trondheim

Chongqing

Master program

HSE:

Health, Safety & Environment

RAMS:

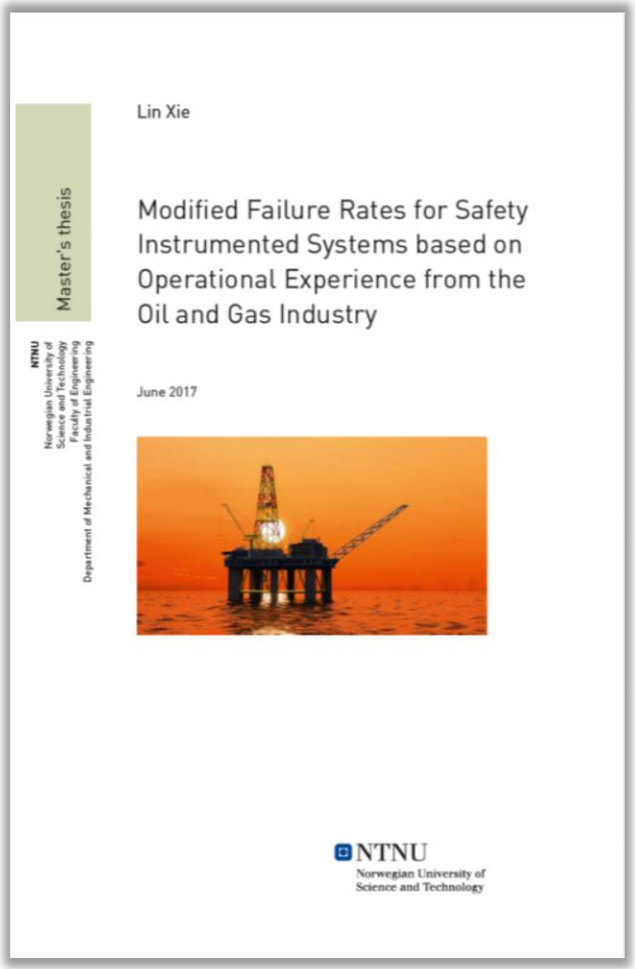
Reliability, Availability, Maintenance & Safety

Master project

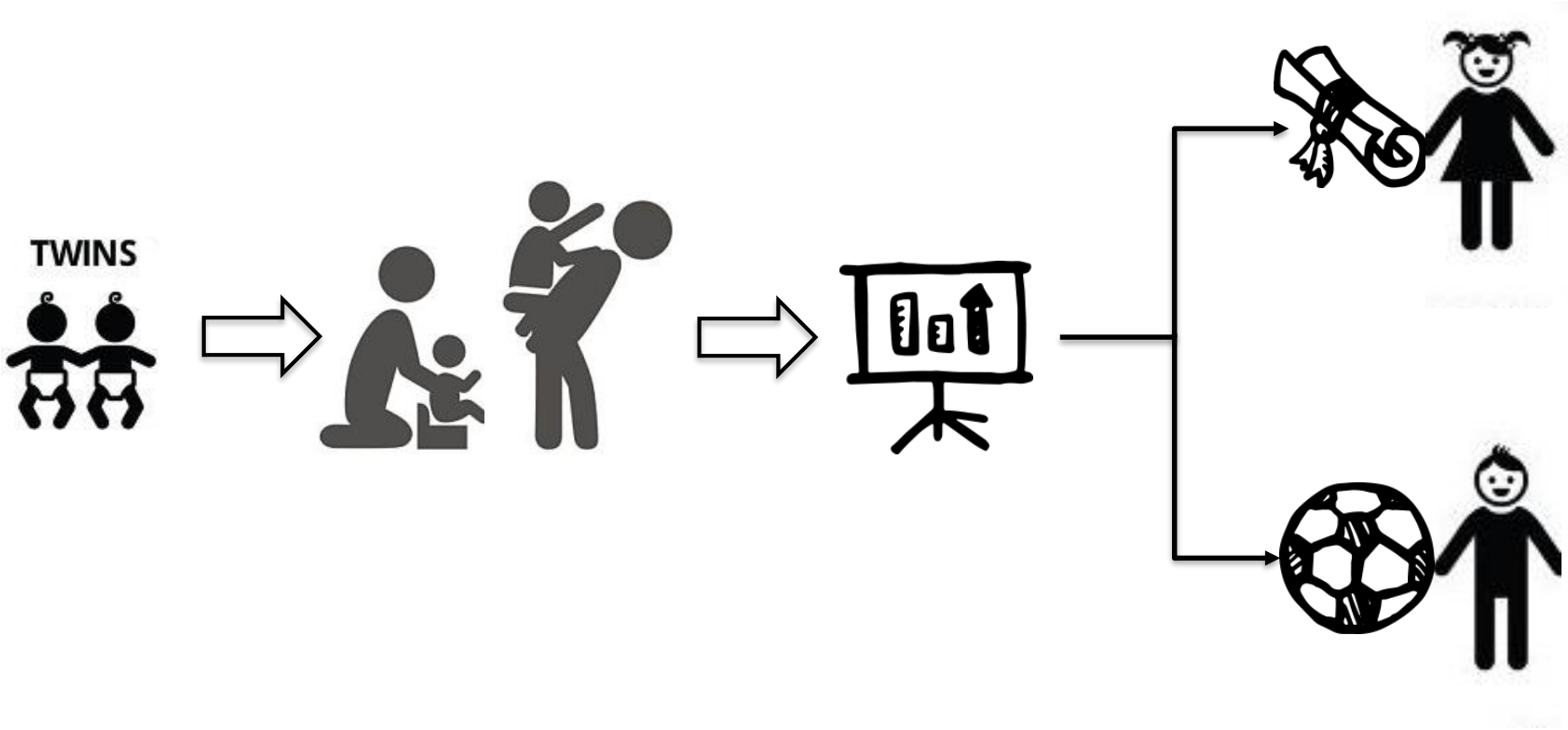
NTNU — Mary Ann Lundteign

SINTEF — Stein Hauge, Solfrid Håbrekke

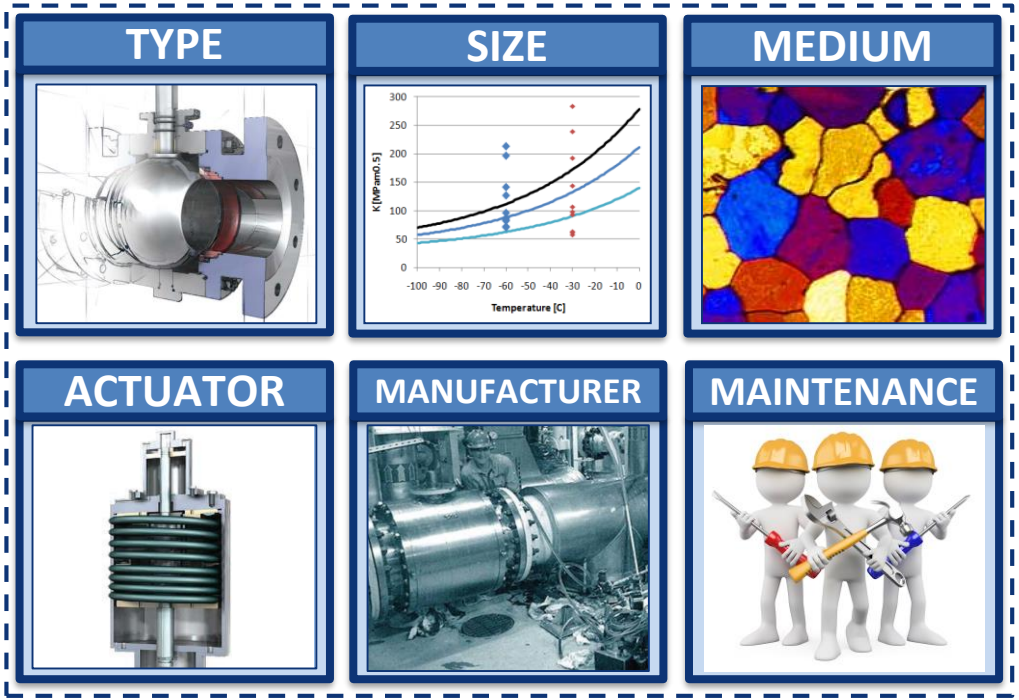
Statoil — Bjørnar Berg, Espen Sørensen



Motivation

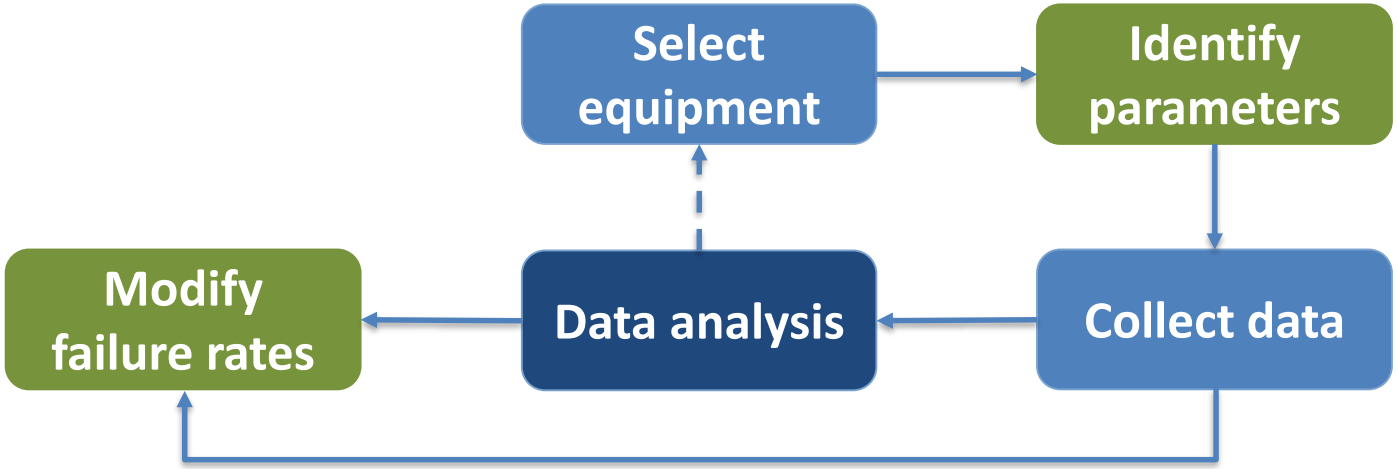


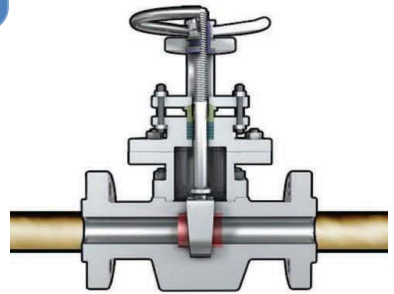
Objectives

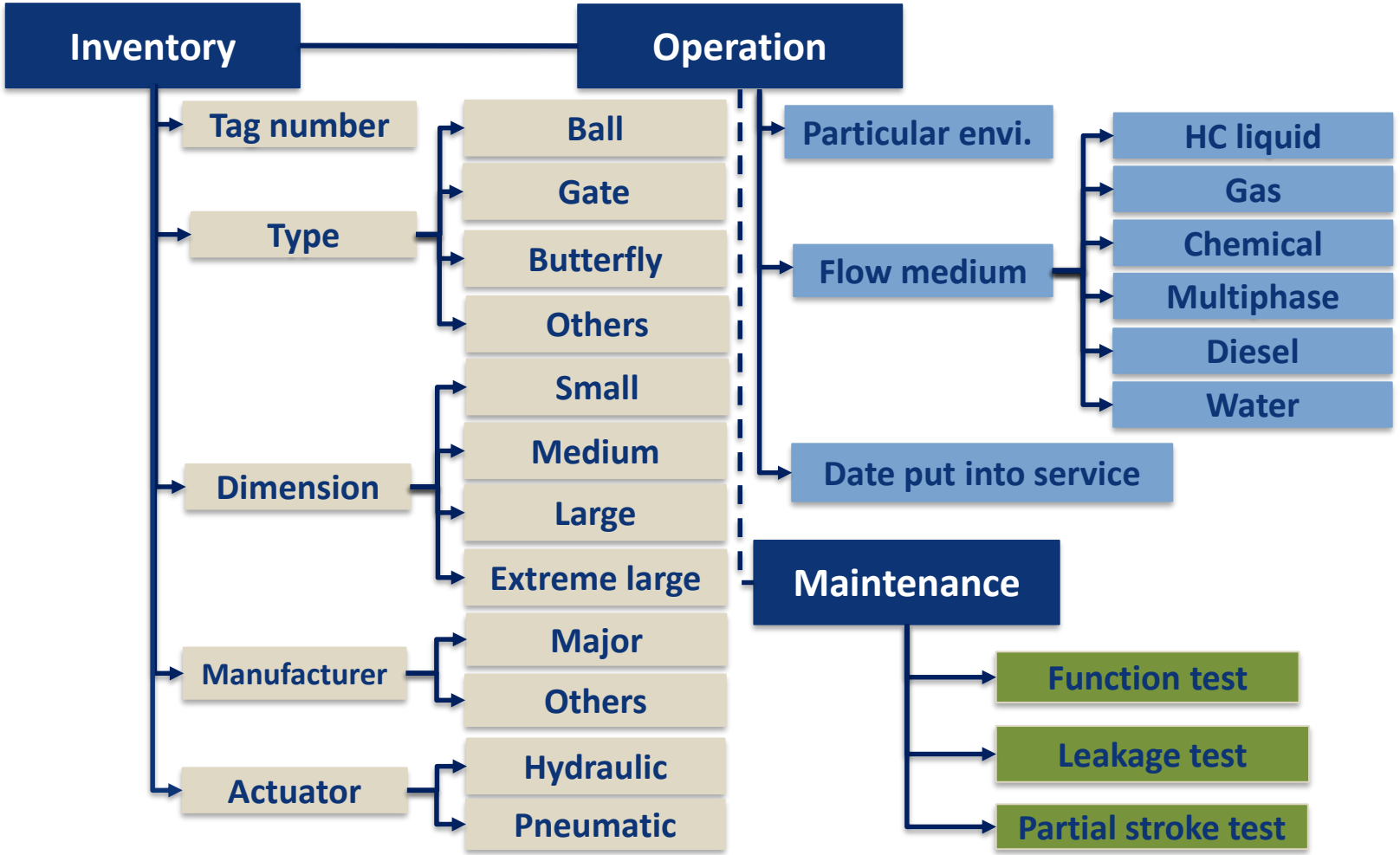

TYPE
SIZE
MEDIUM
ACTUATOR
MANUFACTURER
MAINTENANCE
K [MPam0.5]
Temperature [C]

FAILURE

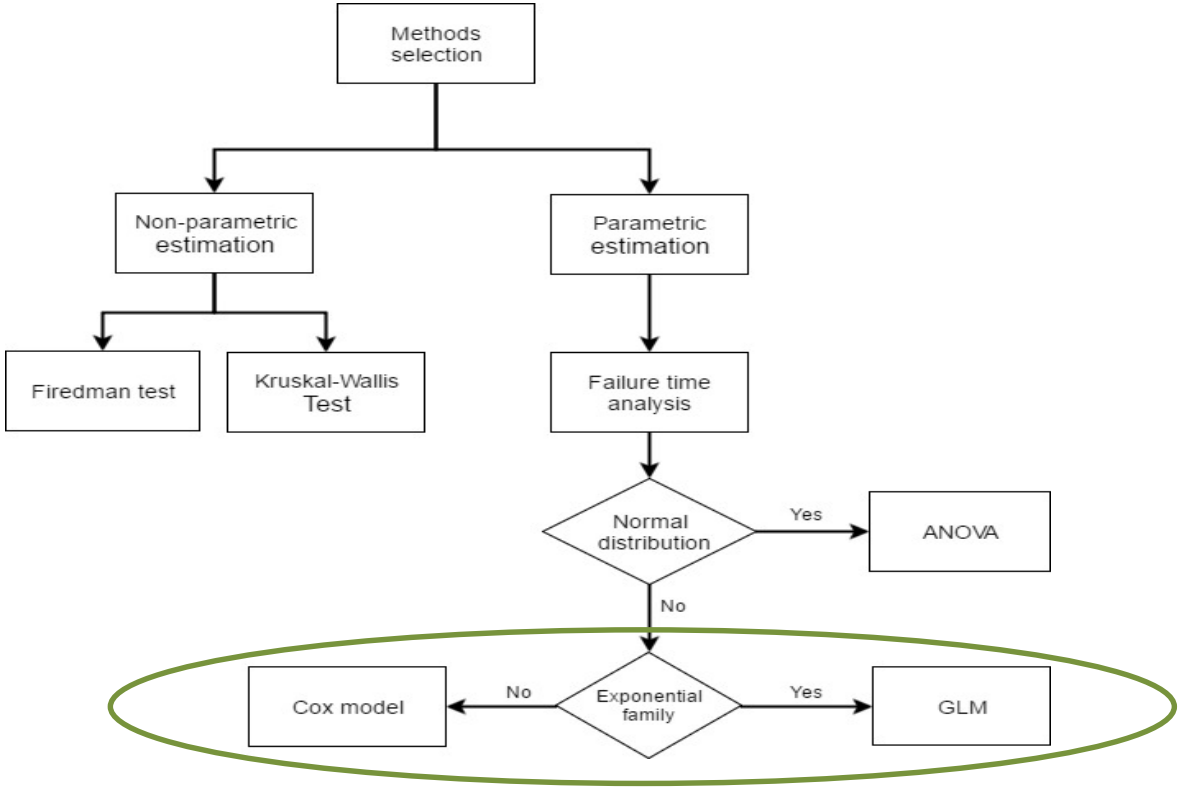
Master project



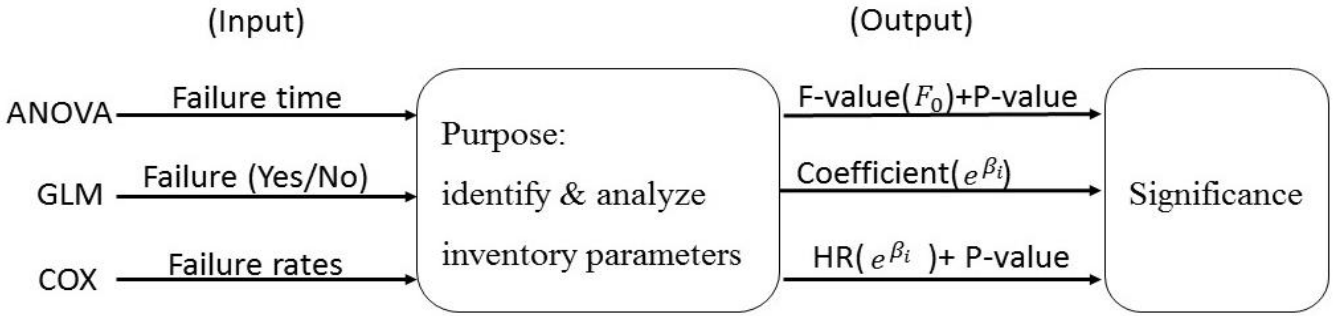



Inventory
Operation
Tag number
Type
Ball
Gate
Butterfly
Others
Dimension
Small
Medium
Large
Extreme large
Manufacturer
Major
Others
Actuator
Hydraulic
Pneumatic
Particular envi.
Flow medium
HC liquid
Gas
Chemical
Multiphase
Diesel
Water
Date put into service
Maintenance
Function test
Leakage test
Partial stroke test

Data analysis

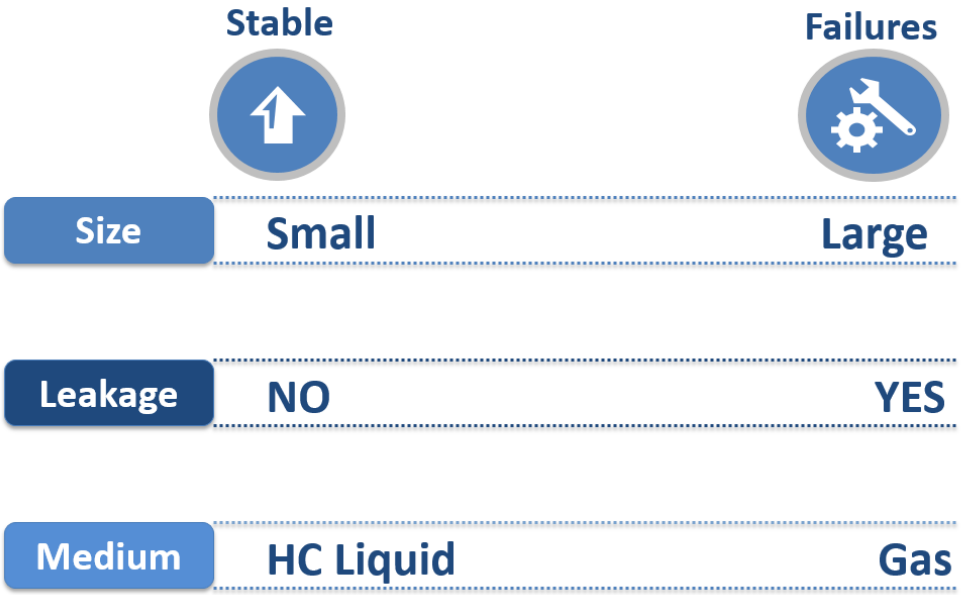


Data analysis method



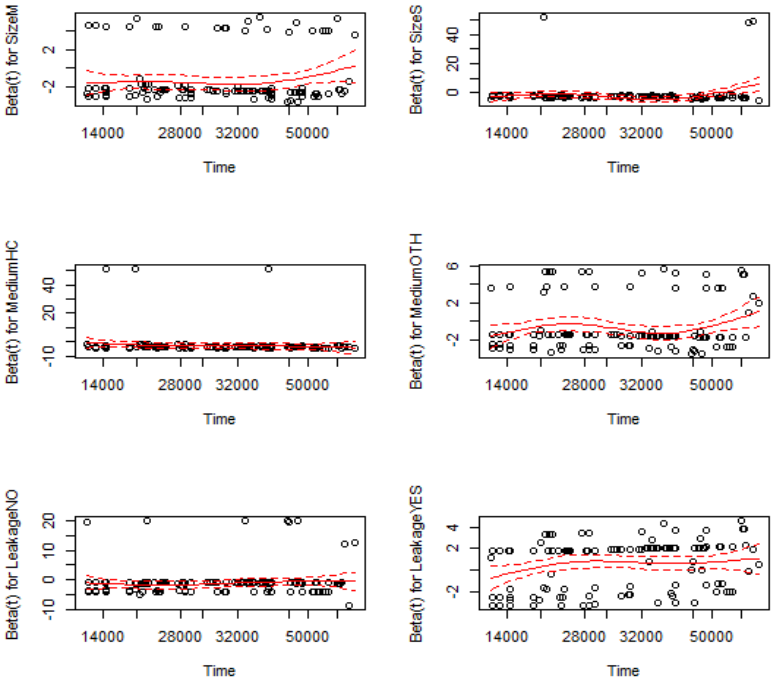
Methods	Distributions	Criteria	Estimations	Formula
ANOVA	Normal distribution	Failure time	Least squares estimation	$T = \sum b_{ik} x_{ik}$
GLM Model	Exponential family (Binomial)	Failure probability	Maximum Likelihood Estimation(MLE)	$\log(\frac{p}{1-p}) = \sum b_{ik} x_{ik}$
COX Model	Free-distribution	Failure rates	Partial likelihood	$\lambda_k = \exp(\sum \beta_{ik} x_{ik})$

Significant parameter

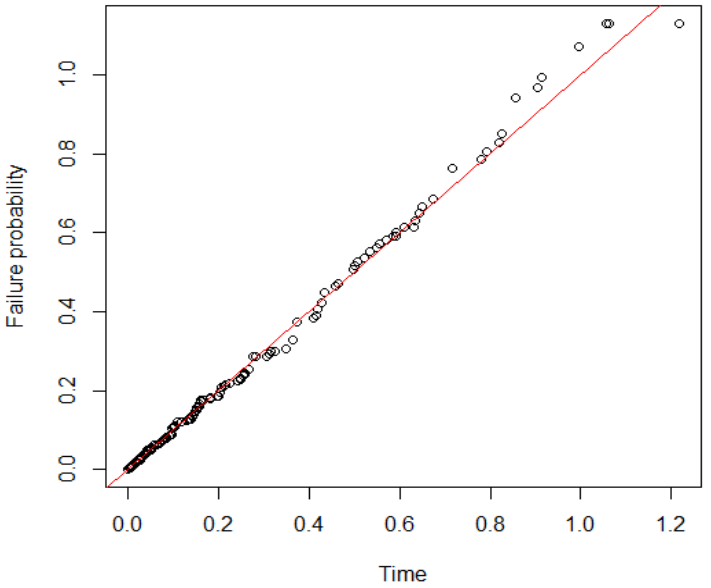


Parameter	Beta	P-value
Size	1.43	4.97E-10
Leakage	0.38	0.86E-03
Medium	-1.27	4.29E-10

Validation

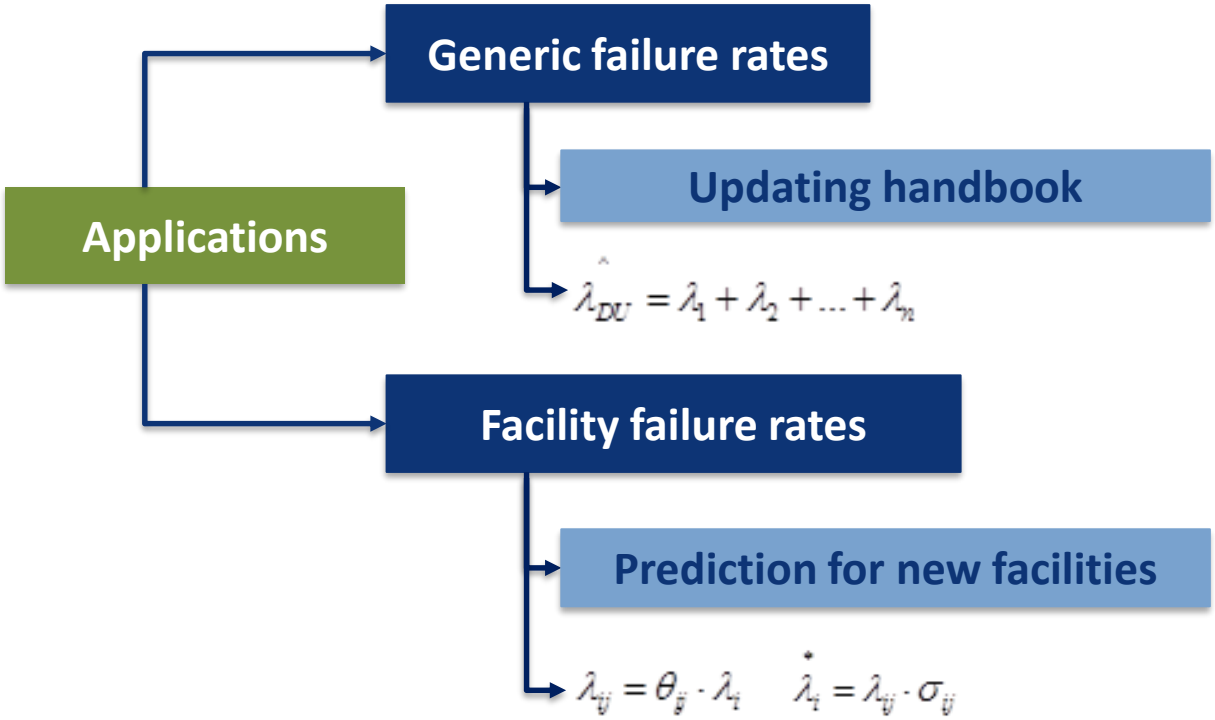


Plots of scaled Schoenfeld residuals against time



Checking goodness of fit for COX model

Modify failure rates



Contributions

- ESREL PAPER 2017

  Modified generic failure rates for safety instrumented systems based on operational experience from the oil and gas industry

  S. Håbrekke, S. Hauge & Å.S. Hoem
  SINTEF, Trondheim, Norway
  M.A. Lundteigen & L. Xie
  NTNU, Trondheim, Norway

- ESREL PAPER 2018

  Adjusted failure rates of safety critical equipment based on inventory attributes

  Håbrekke S [1] , Hauge S [1] , Xie L [2] , Lundteigen M [2]
  [1] SINTEF Technology and Society, Trondheim, Norway

Challenges

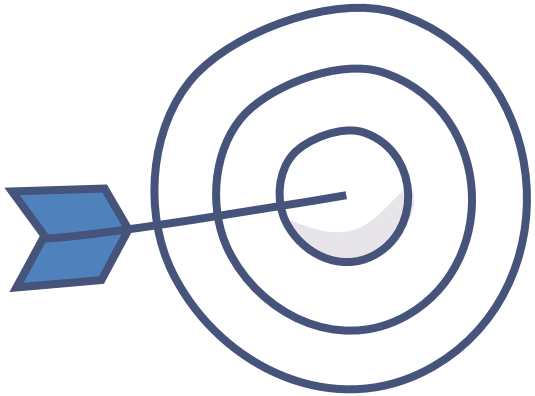
Data collection

Mathematic model

Dynamic VS static

Research framework

- Complex Network System
- Motivation
- Examples



Research questions

Definition

- Complex system
- Complexity

Attributes

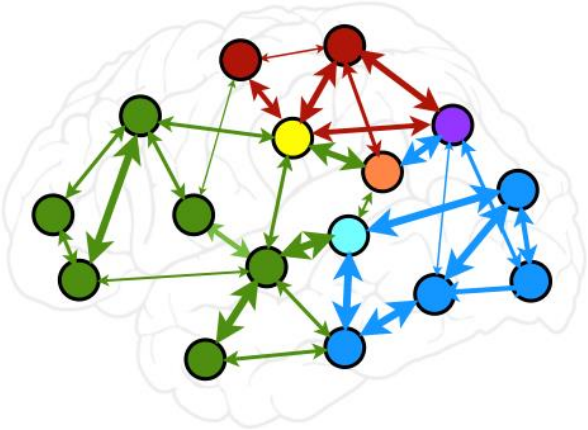
- Interdependency
- Large scale

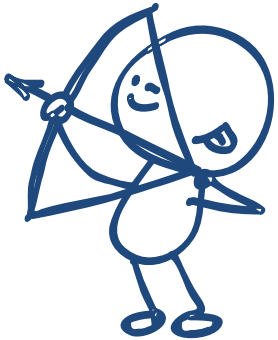
Failures

- Behavior
- Effect

Barriers

- Capacity
- Performance





PhD project

- Supervisor: Yiliu Liu
- Co-supervisor: Mary Ann Lundteign

Literature review

- Identify problems
- Search for theory

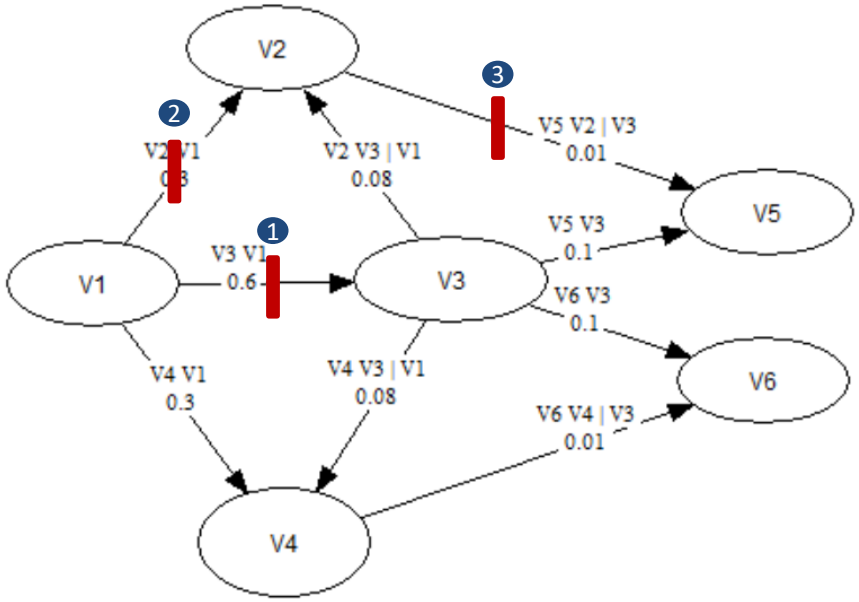
Develop methods

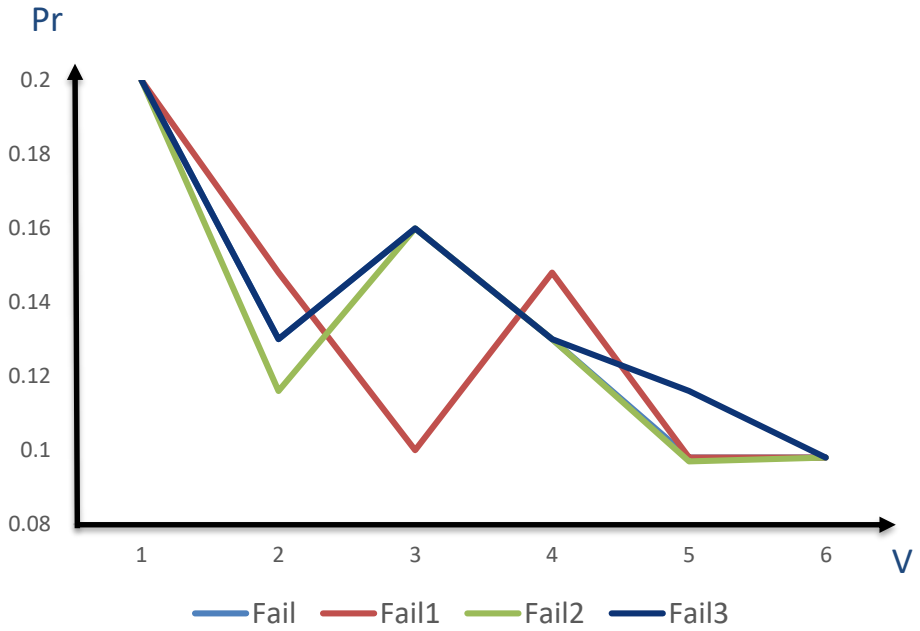
- Develop new model
- Propose new methods

Data analysis and application

- Data analysis
- Applications

Case study

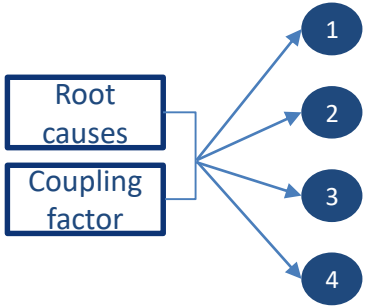

V2
3
2
V5 V2 | V3
0.01
V2 V1
0.3
V2 V3 | V1
0.08
V5
1
V5 V3
0.1
V3 V1
0.6
V1
V3
V6 V3
0.1
V4 V1
0.3
V4 V3 | V1
0.08
V6
V6 V4 | V3
0.01
V4

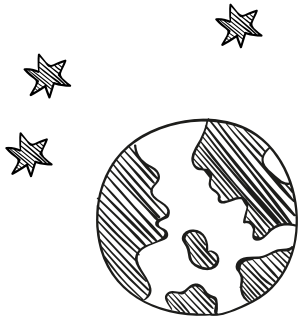

Pr
0.2
0.18
0.16
0.14
0.12
0.1
0.08
1
2
3
4
5
6
V
Fail
Fail1
Fail2
Fail3

Short term

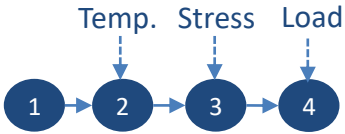
ESREL 2018

- **Common Cuase Failure**

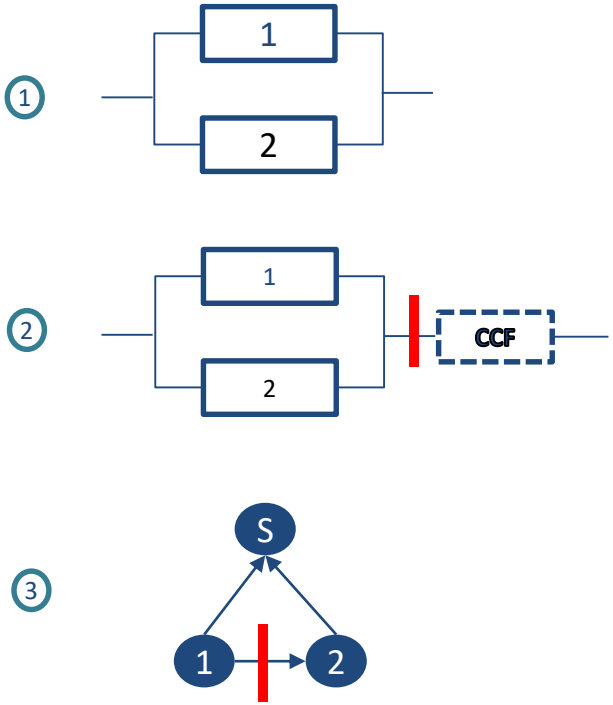


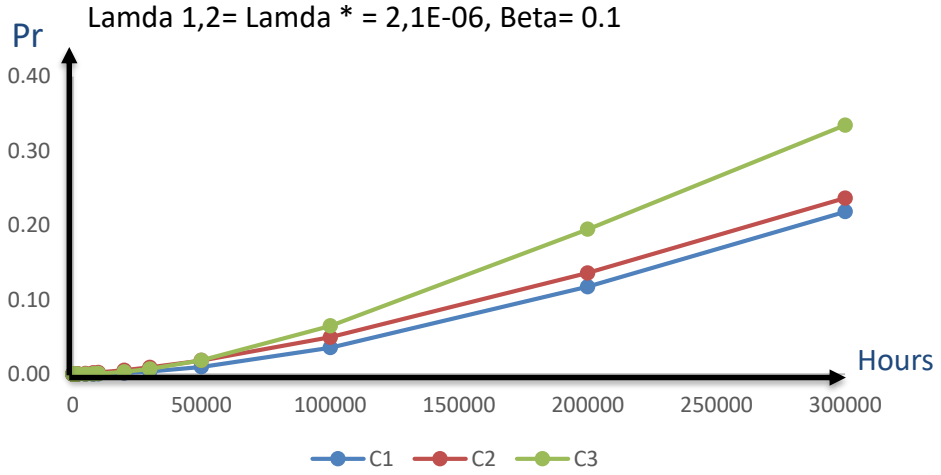


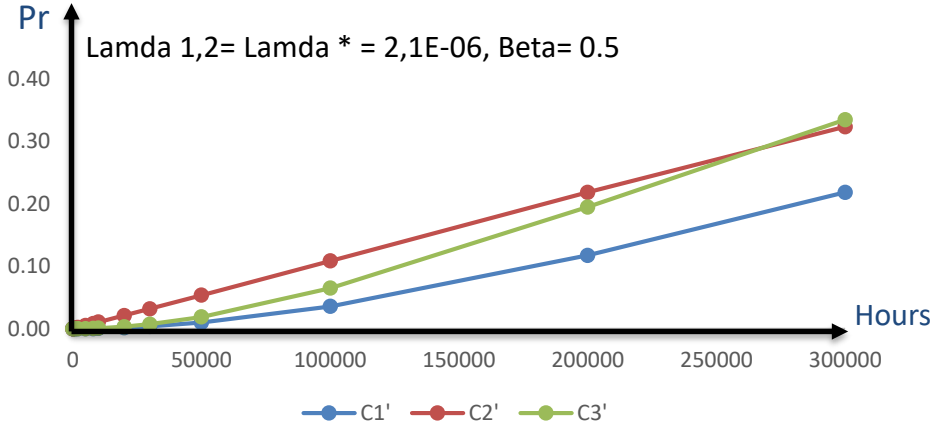
- **Cascading failure**



Case study







NTNU

Thanks