

# Obsolescence engineering: challenges and ongoing initiatives in France

Who are we?

# French Institute of Obsolescence



Sid-Ali Addouche (Dr.)  
Vice-President,  
Scientific Affairs



Claude Baron (Pr. Eng.)  
Senior Scientific Advisor



Kevin Boissié (Dr.)  
Vice-President,  
Industrial Affairs

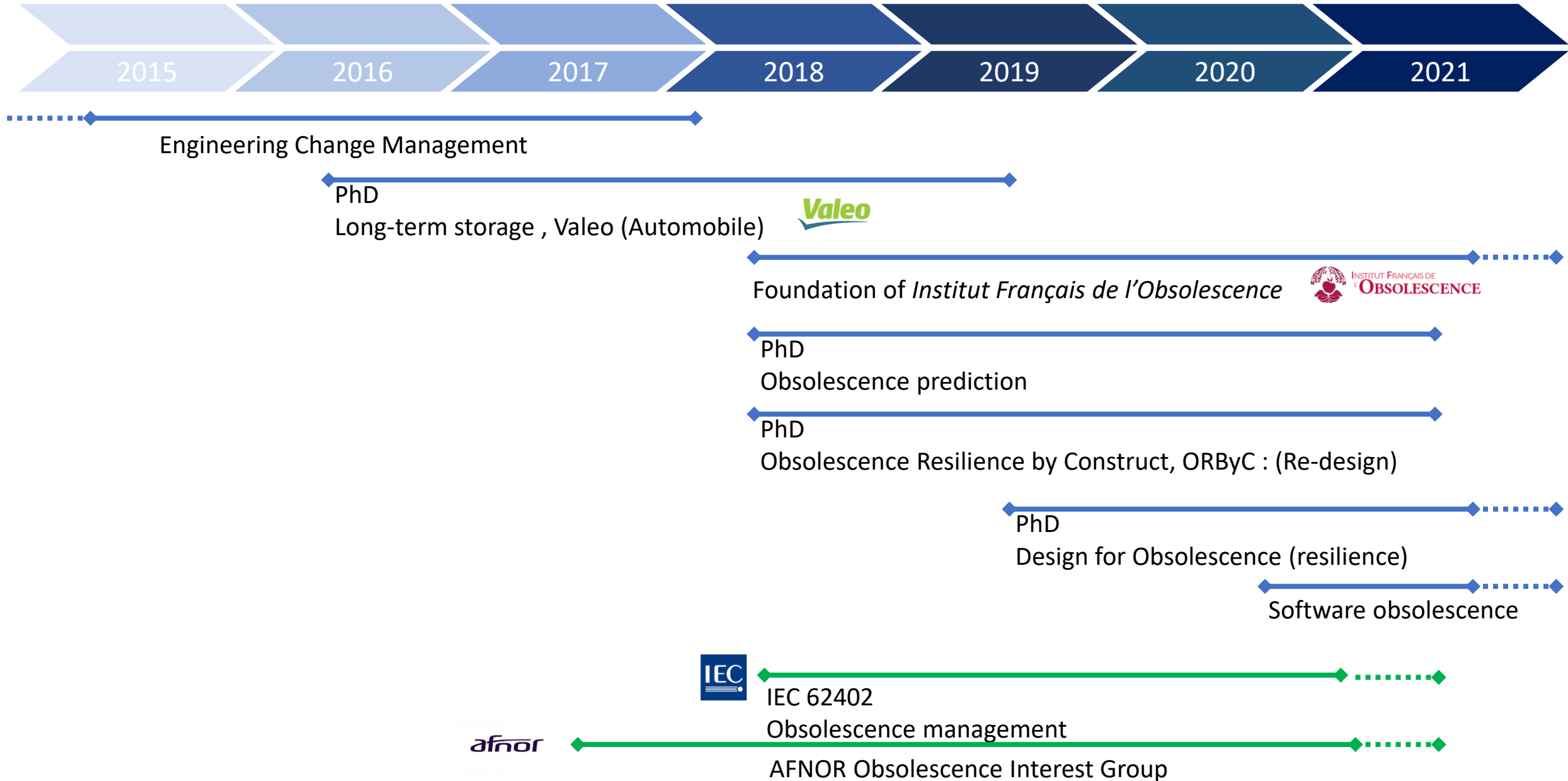


Marc Zolghadri (Pr.)  
President



What are we doing ?

# Research activities



# Structuring activities

2015

2016

2017

2018

2019

2020

2021

Mrs. Robin Brown & Mr. Tracy Daubenspeck  
OSD Parts Mgt. Program Manger  
OSD DMSMS Program Manager



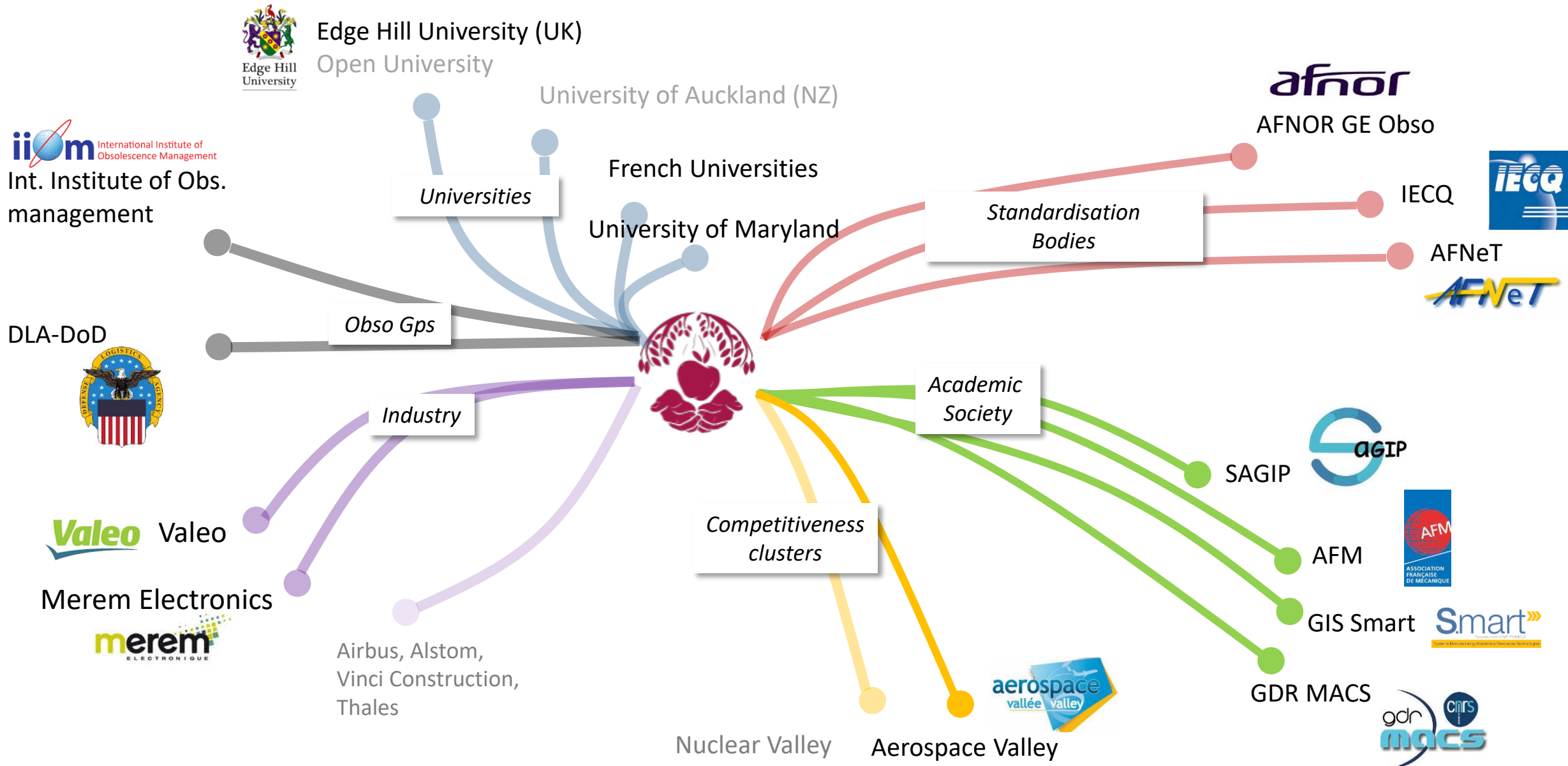
Parts & Material Management Working Group  
SD-22 (2020)

Wolfgang Heinbach (President, DE)  
Stuart Broadbent (Director, UK)



Creation of France Chapter of IIOM  
(2021)

# Networking activities



# Networking activities

- AFNOR special interest group « Obsolescence of electronic components»
- More than 25 years of experience
- 48 companies – 90 experts
- Two working groups: WG Brokers + WG Storage
- Contributions:
  - UTE C 96-004:2008 ; Audit for obsolescence management
  - UTE C 96-027:2011 ; Obsolescence management – Application guide (collaboration IEC 62402)
  - UTE C 96-027-1:2011 ; Obsolescence of electronic equipment – Applied guide for obsolescence management
  - UTE C 96-029:2011 ; Long duration storage of electronic components – Guide for implementation
  - UTE C 96-029-1:2011 ; Guide méthodologique de dimensionnement des stocks de fin de vie des composants et sous-ensembles électroniques



# Defence networking activities

- Etat Major de l'Armée de l'Air et de l'Espace  
(French Aerospace Army General Staff)



- Obsolescence management for fighter aircrafts



- Obsolescence management for armoured personnel carrier

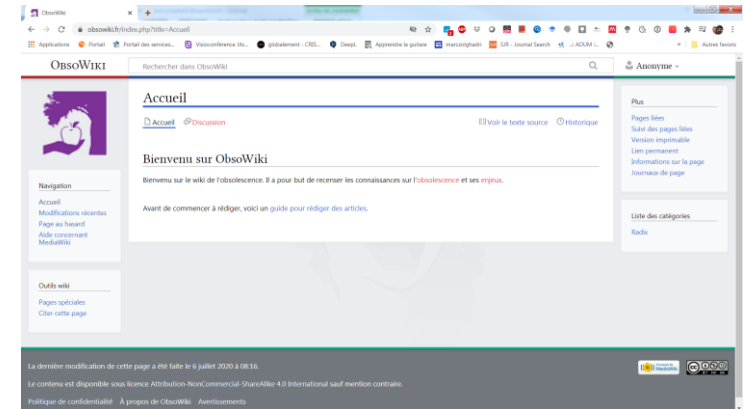


- Collaborations with « Ecole de l'Air » and « CREA »



# « Tooling » ‘in progress’ activities

- French national research center: Action « Obsolescence » 2020-2022
- ObsoWiki



- « 1st Obsolescence and Innovation Days », April 2021
- COBRA (Control of Obsolescence Risk and Assessment)
  - Platform to support Obsolescence management
- White paper: Obsolescence (Fr.)



What do we think we should do ?

Basic considerations

# Collaborative Research

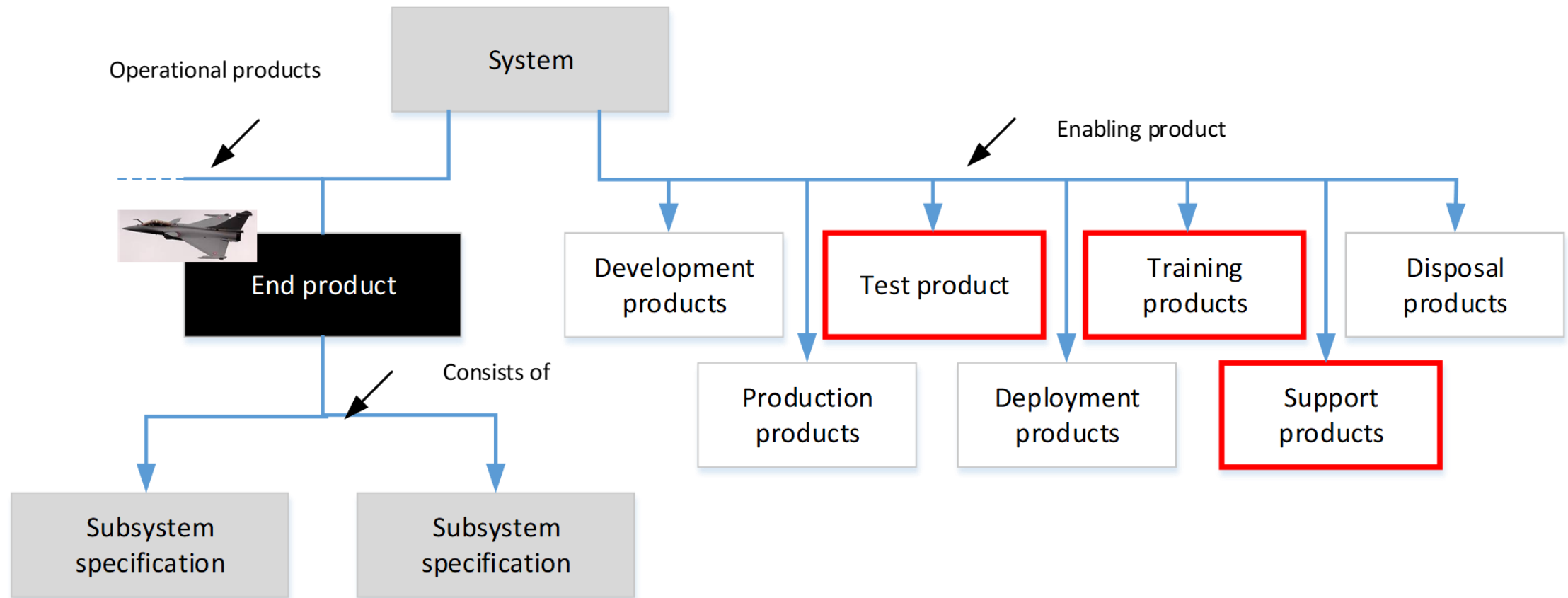
## Impacts on system requirements

(ISO/IEC/IEEE 29148, 2011)  
Systems and software engineering — Life cycle processes — Requirements engineering



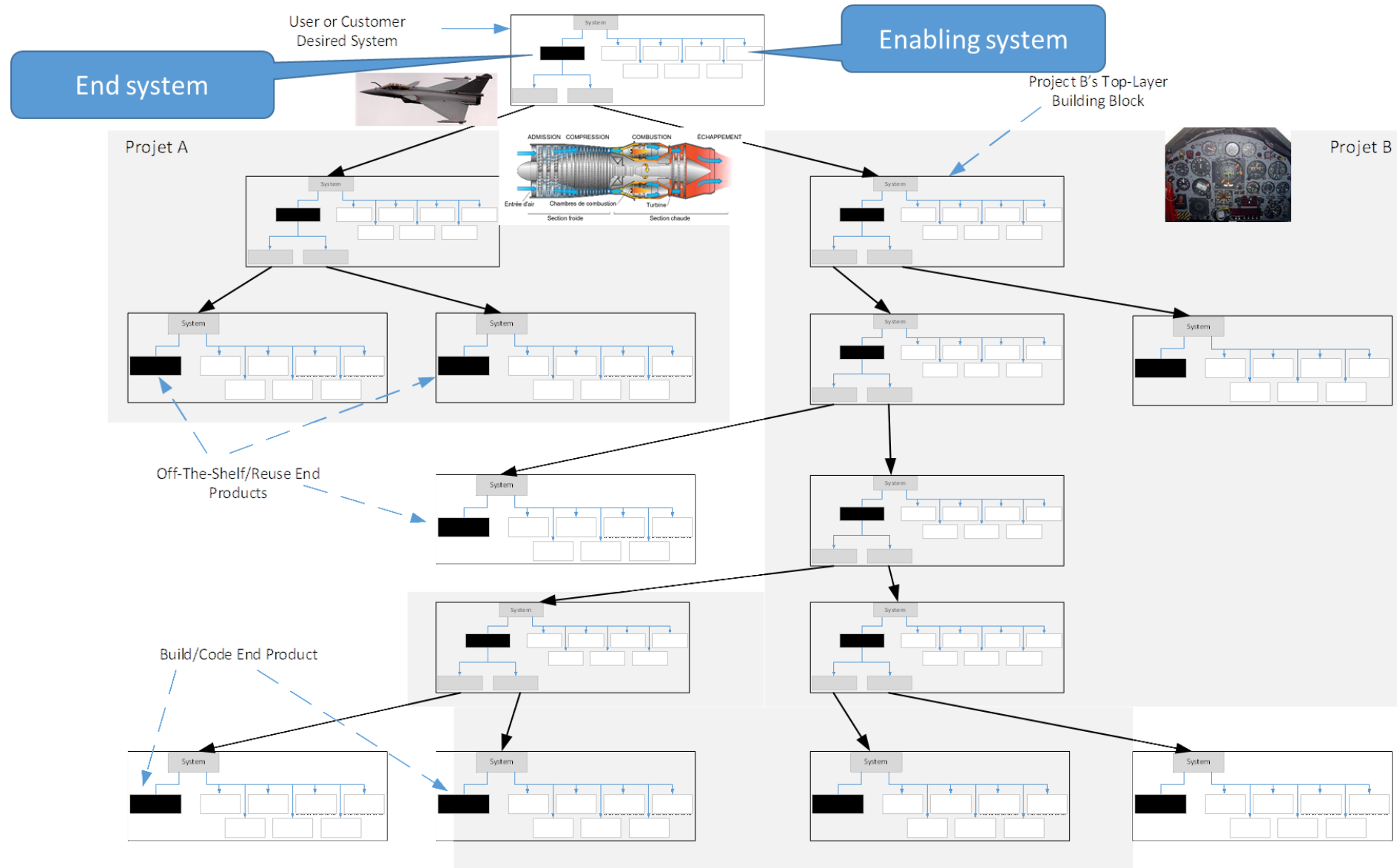
# Collaborative Research

Final products and enablers (ANSI/EIA 632)



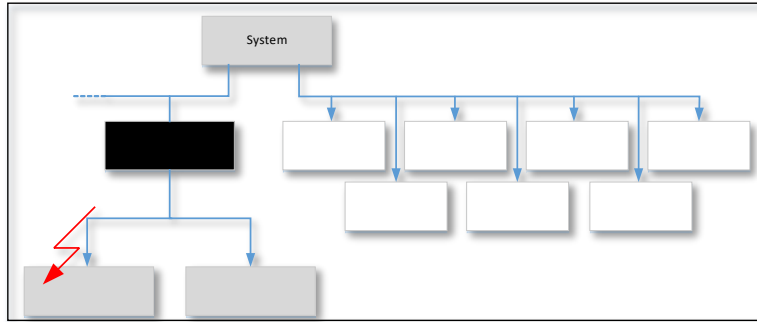
# Collaborative Research

## Final products and enablers (ANSI/EIA 632)

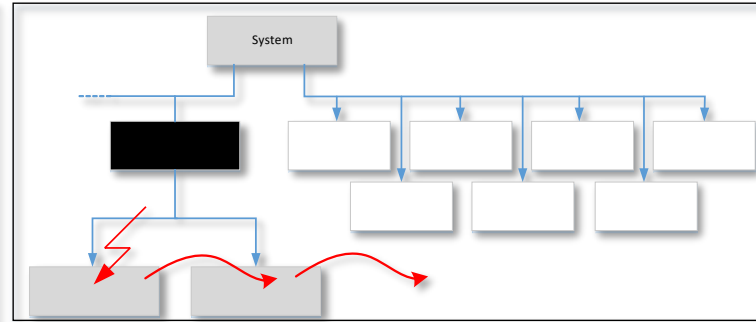


# Collaborative Research

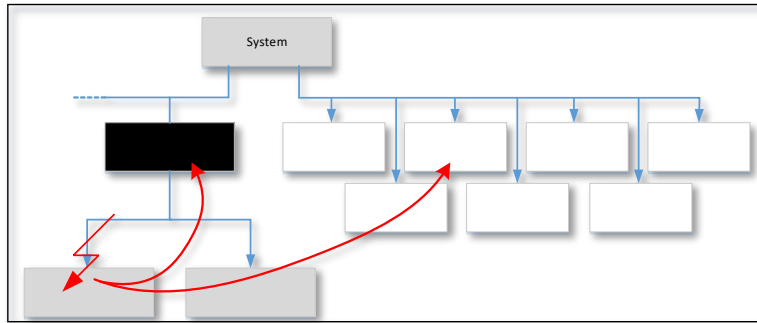
Final products and enablers (ANSI/EIA 632): propagation matters



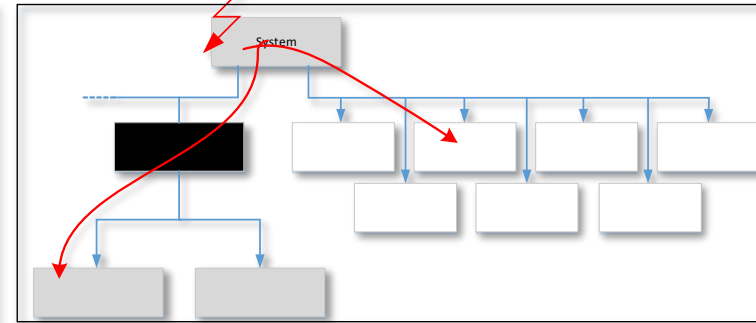
(a) No propagation



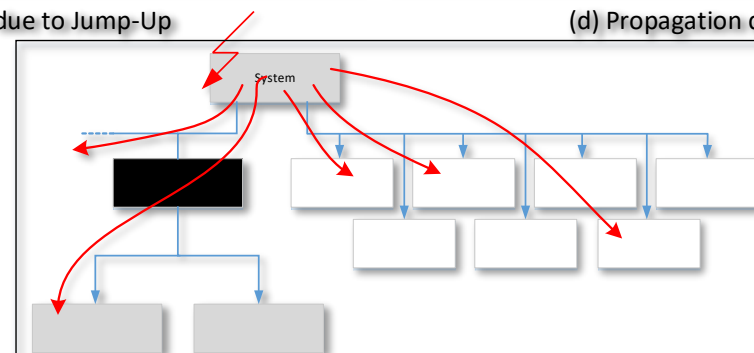
(b) Propagation due to dependency



(c) Propagation due to Jump-Up



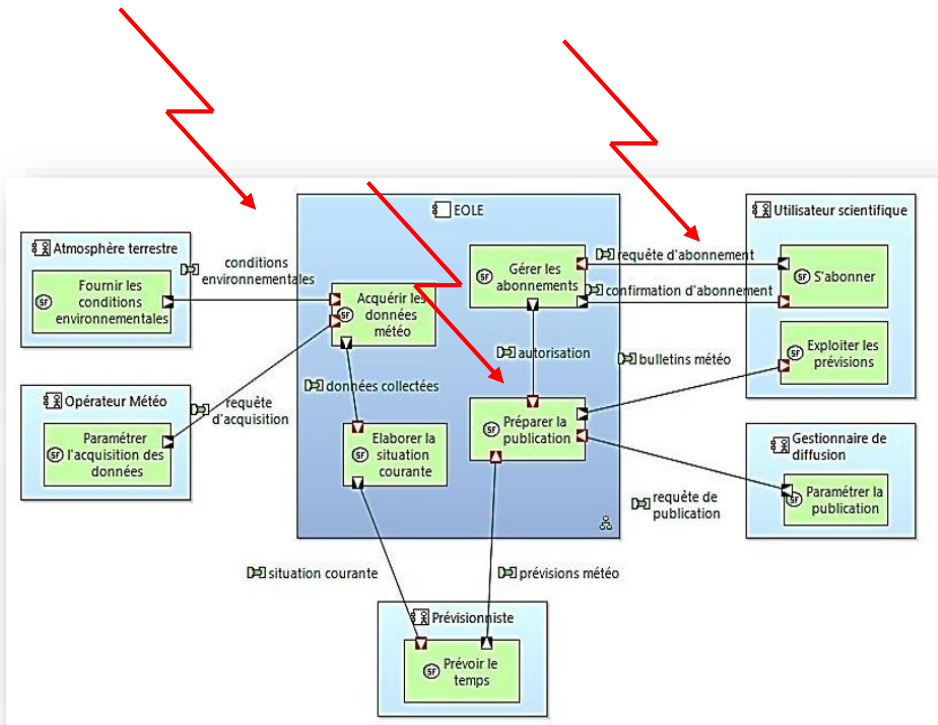
(d) Propagation due to Jump-down



(e) Multi-domain propagation

# Collaborative Research

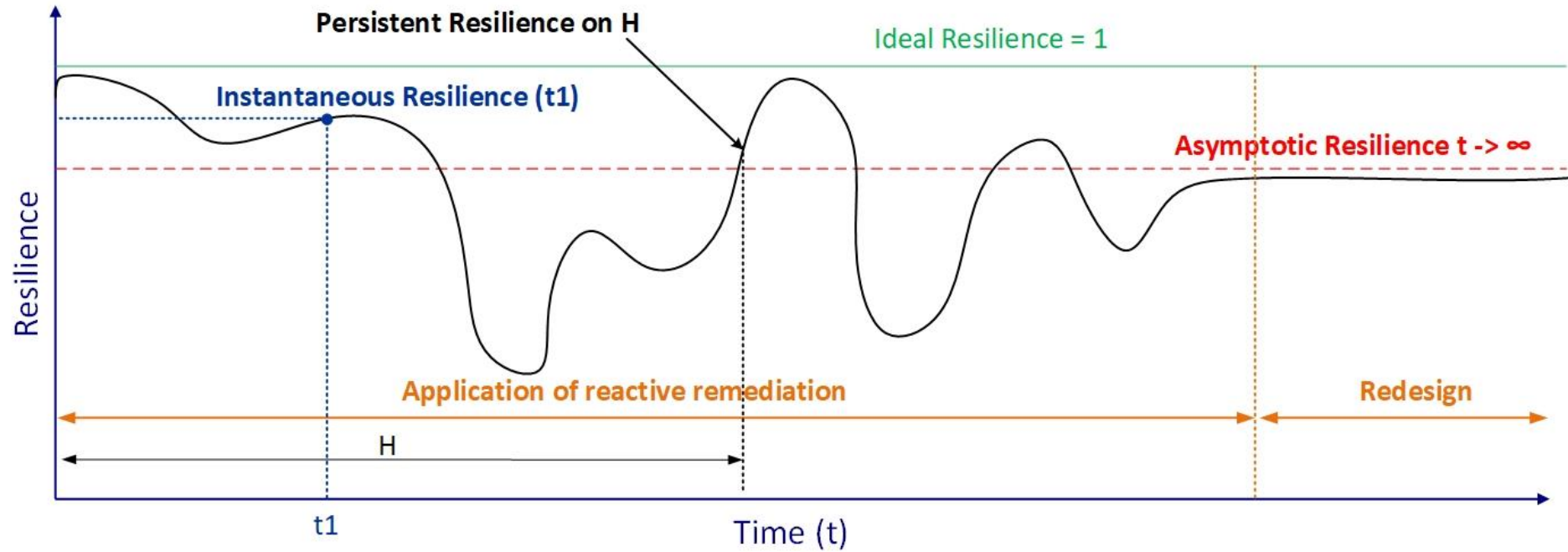
Final products and enablers (ANSI/EIA 632): propagation matters





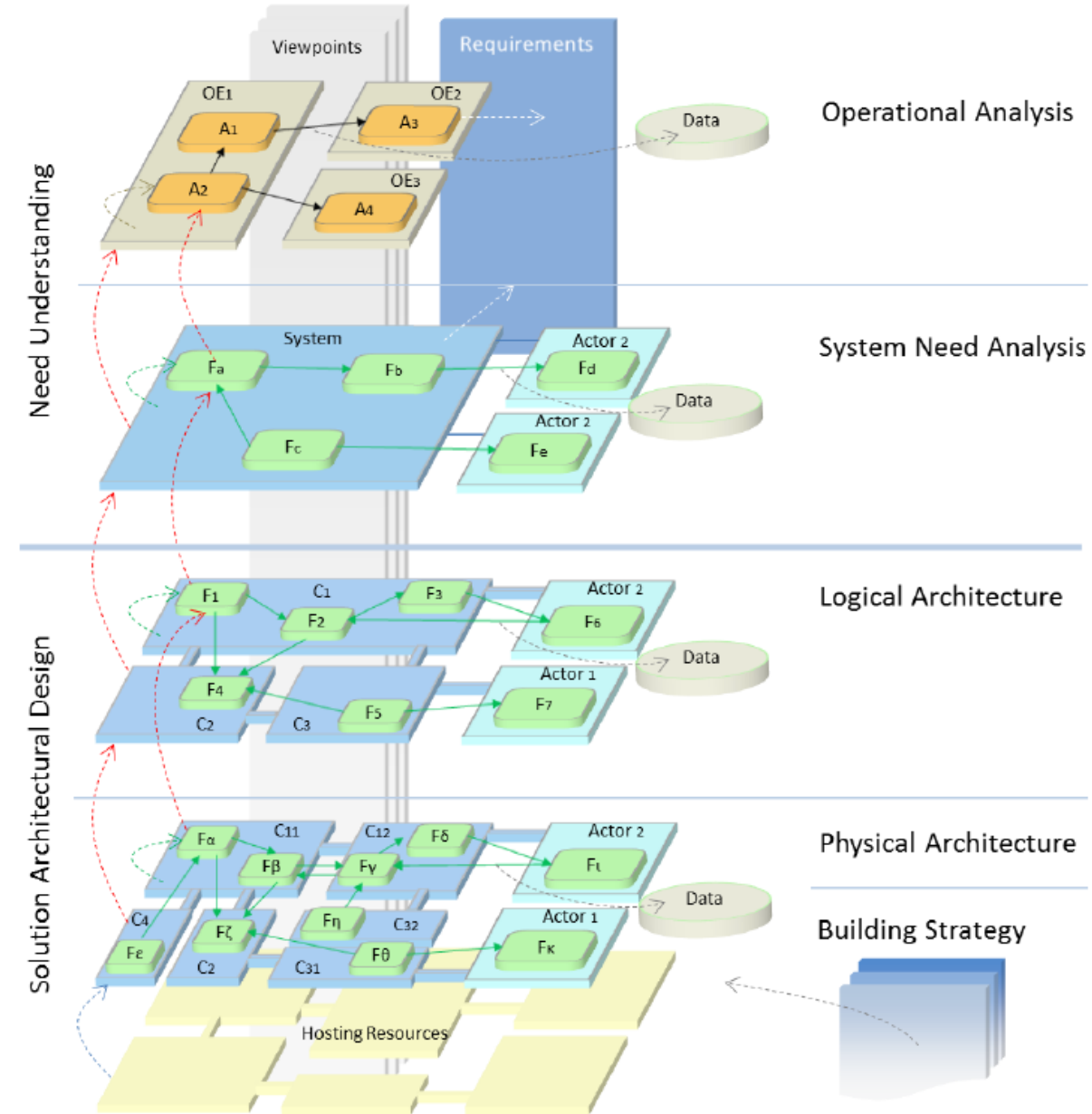
# Research roadmap

## 1. Obso-Resilience: characterisation and quantification *[Amel Soltane PhD]*



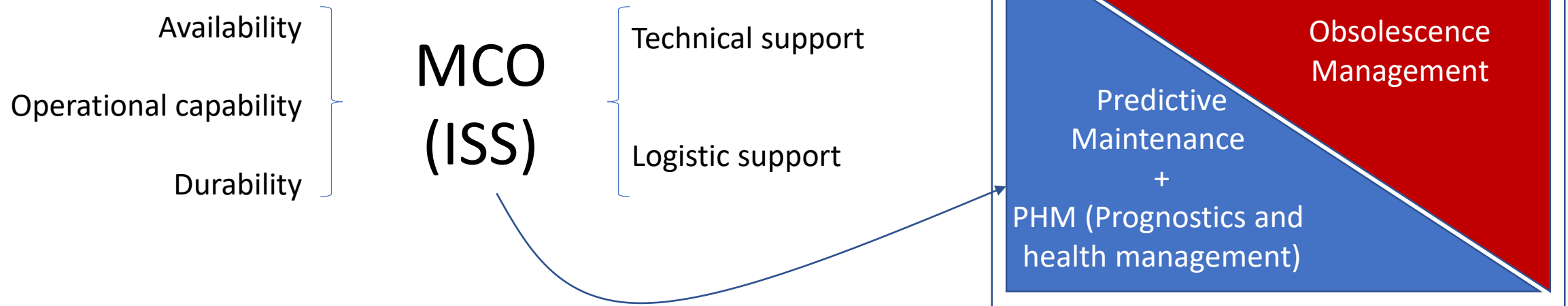
# Research roadmap

1. Obso-Resilience: characterisation and quantification
2. **O**bsolence **R**esilient **B**y **C**onstruct (ORByC)



# Research roadmap

1. Obso-Resilience: characterisation and quantification
2. Obsolescence Resilient By Construct (ORByC)
3. **Obslcescence management: In-Service Support\***
  - Complex systems in
  - Extreme conditions



# Research roadmap

1. Obso-Resilience: characterisation and quantification
  2. Obsolescence Resilient By Construct (ORByC)
  3. Obslcescence management for defence: In-Service Support (Maintien en Conditions Opérationnelles\*)
- Workshop Obsolescence and Innovation: 6th/7th April 2021
    - International Obsolescence and Innovation Days (P.Sandborn), since 2022
  - Sessions in international scientific conferences: ex. CIGI-QUALITA 2021
  - Special issues in Journals
  - Training and credential (students and professionals)
  - International working groups: academia + industry

# Sectorial roadmap

- Defence



nexter

- Car industry



RENAULT

# Future of French Institute of Obsolescence?



⇒ Become the French Chapter in 2021

⇒ Two goals

Research

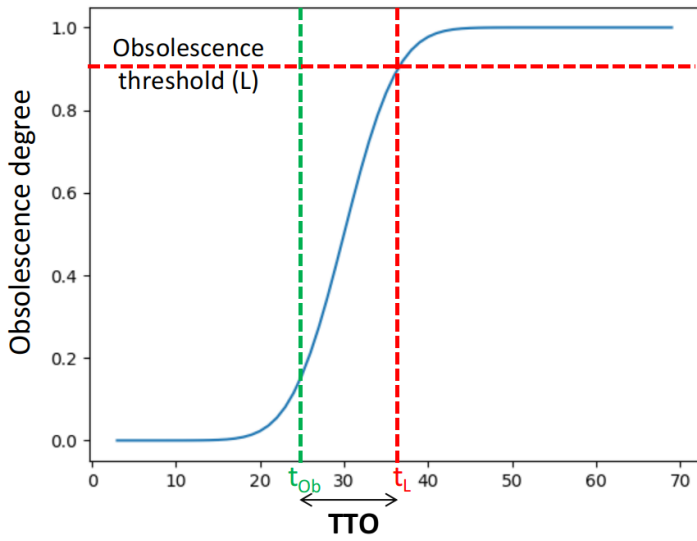
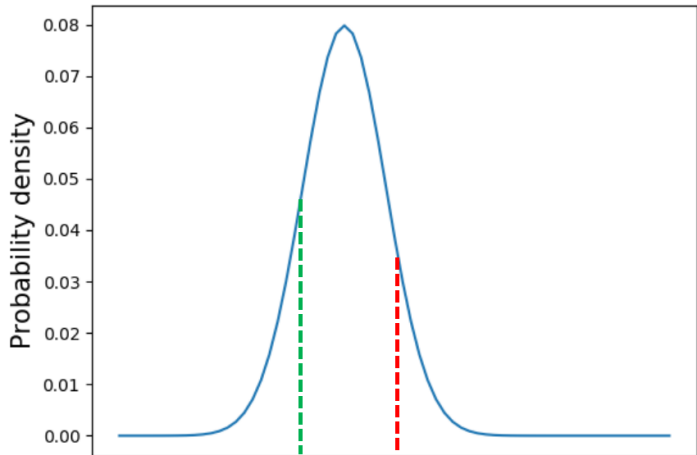


Training programs (Engineering – Business field) and credential

National and International Collaborative projects

Some research results

# Obsolescence prediction [Trabelsi, 2021]



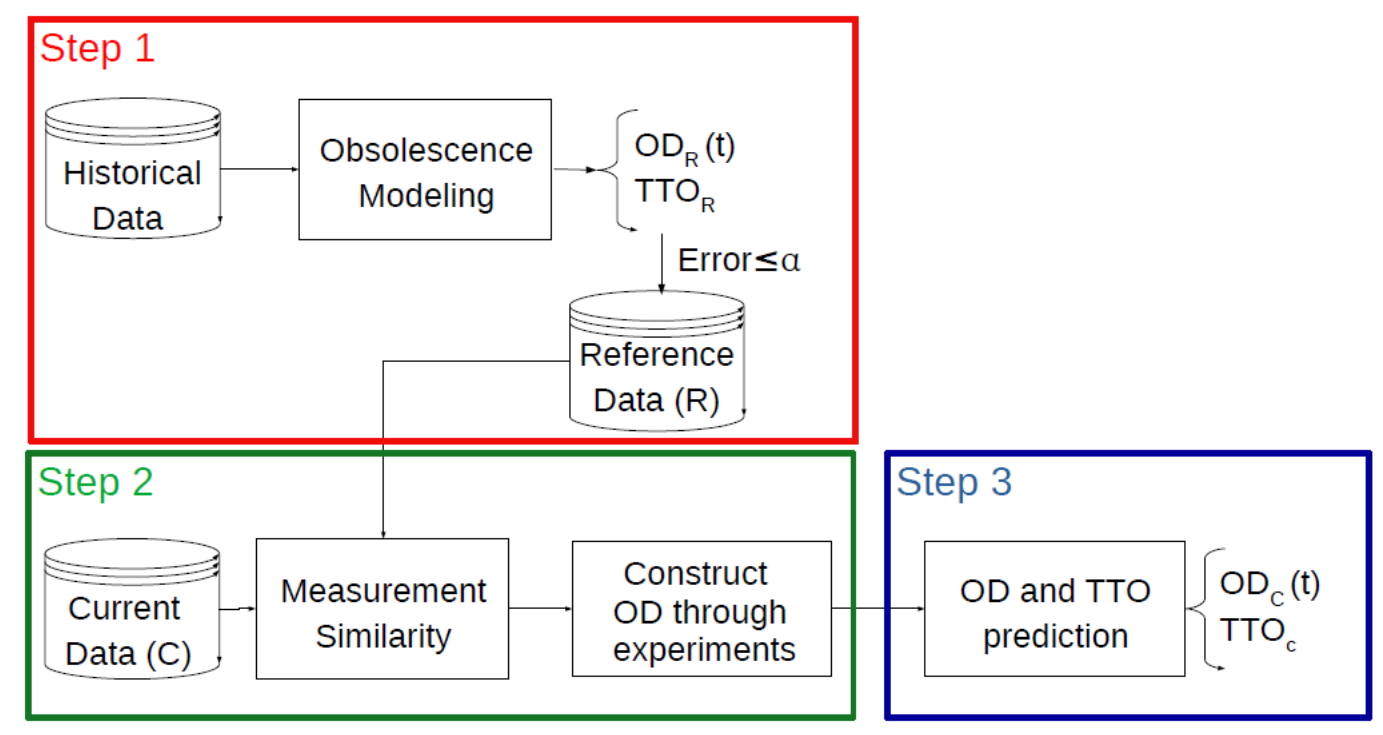
$$TTO = t_L - t_{ob}$$

$$OD(e) = p(t \leq t_{ob}) = \int_{-\infty}^{t_{ob}} g(t, a, b, \dots) dt$$

Weibull distribution:

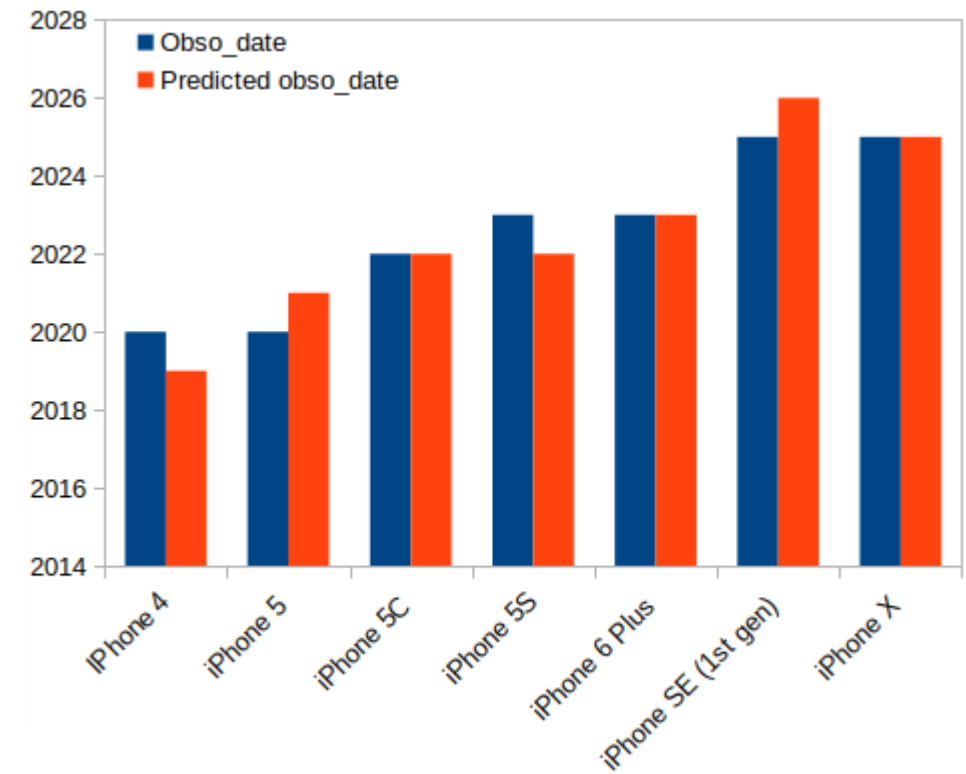
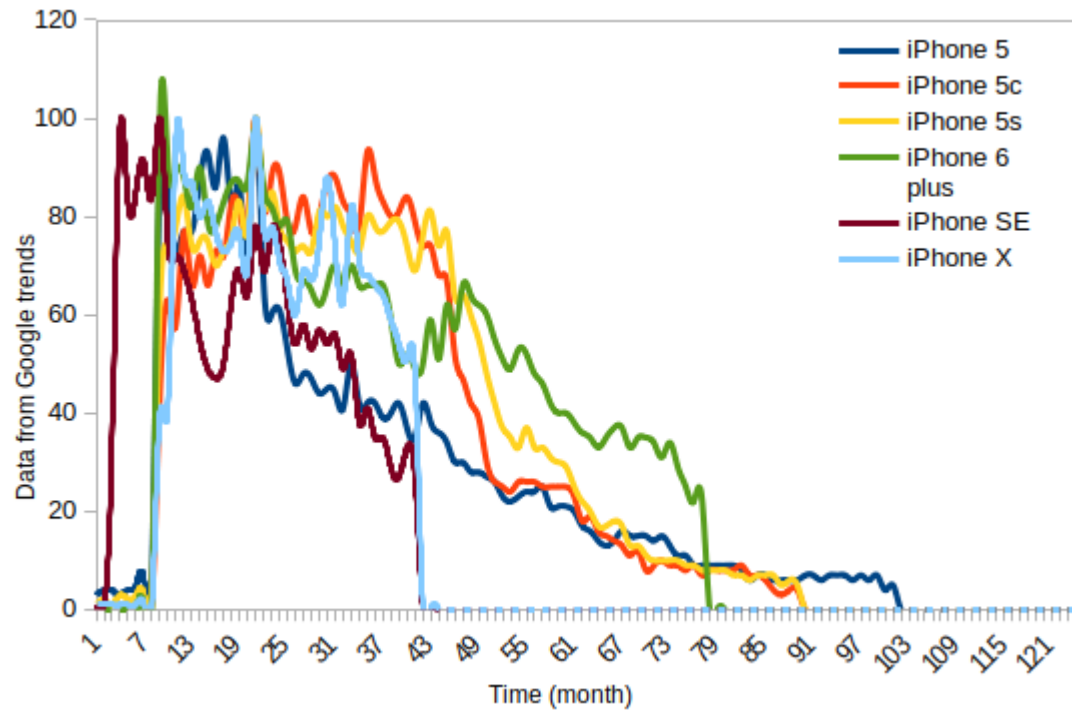
$$g(t, k, \lambda, \theta) = \frac{k}{\lambda} \left(\frac{t-\theta}{\lambda}\right)^{k-1} e^{-\left(\frac{t-\theta}{\lambda}\right)^k}$$

$$OD(t) = P(t \leq t_{ob}) = 1 - e^{-\left(\frac{t}{\lambda}\right)^k}$$

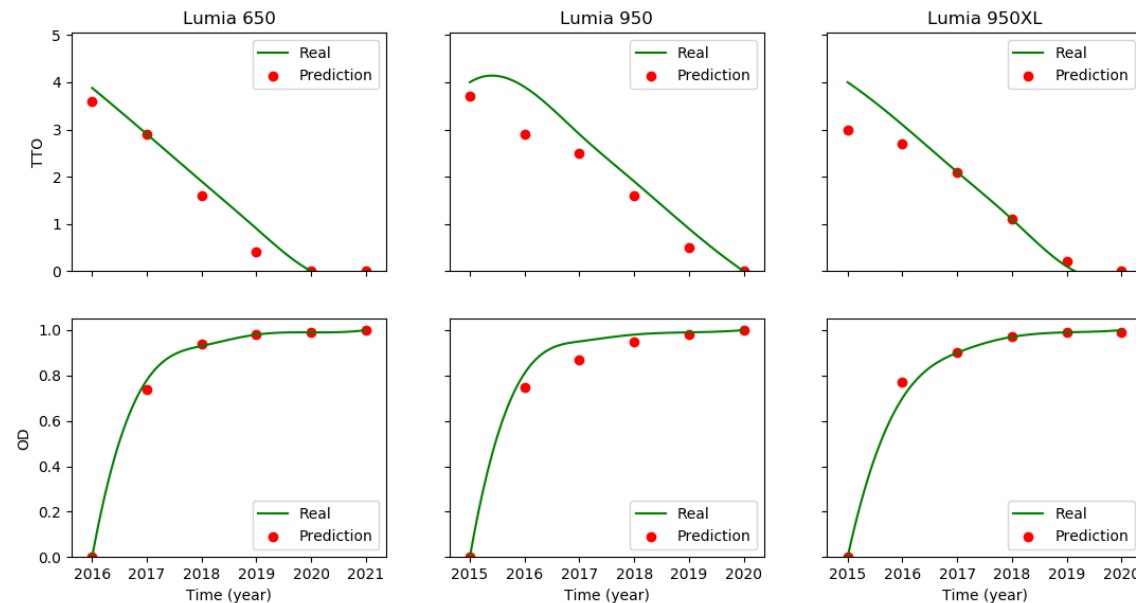




Google trends

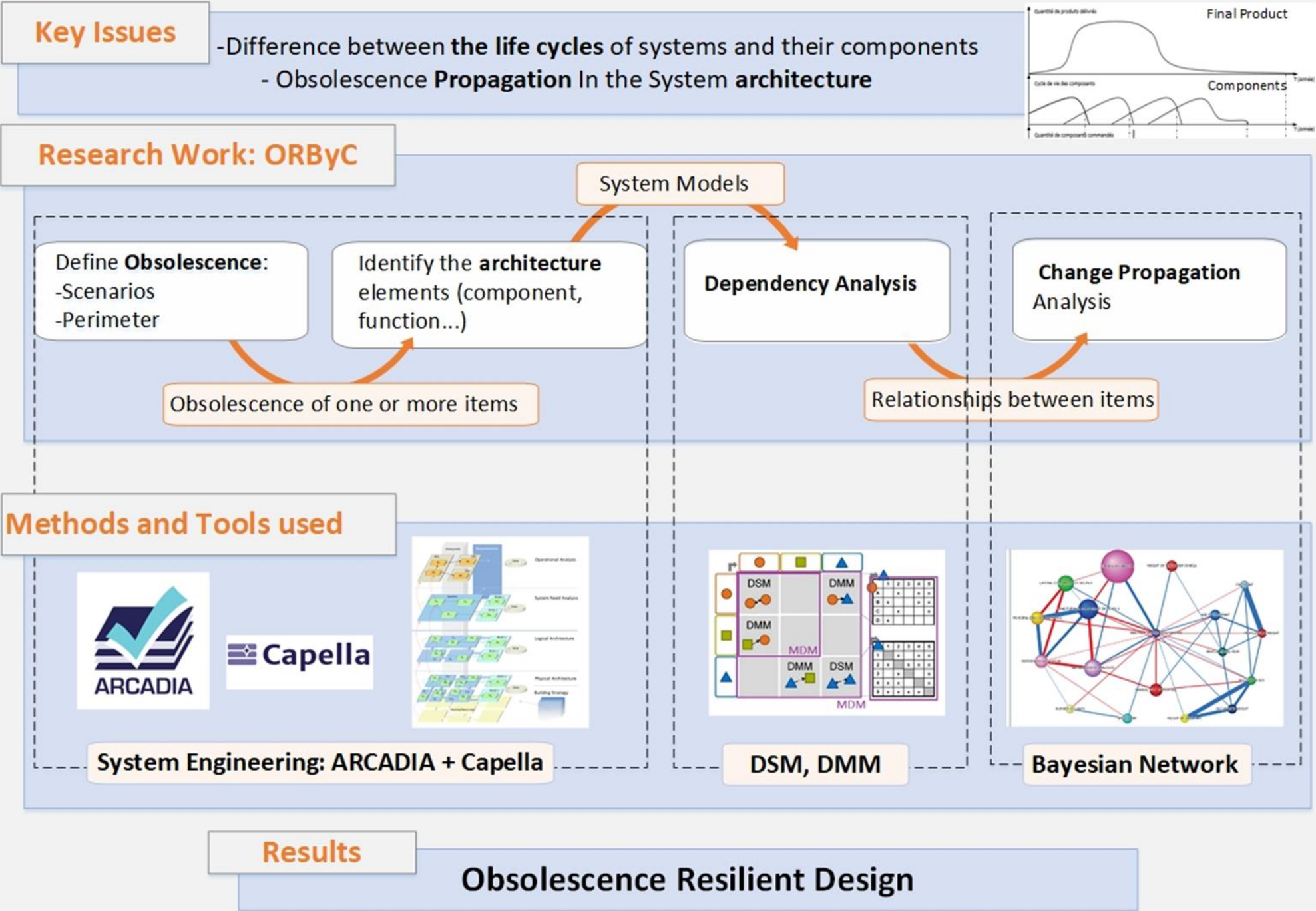


Usability test for Microsoft smartphones

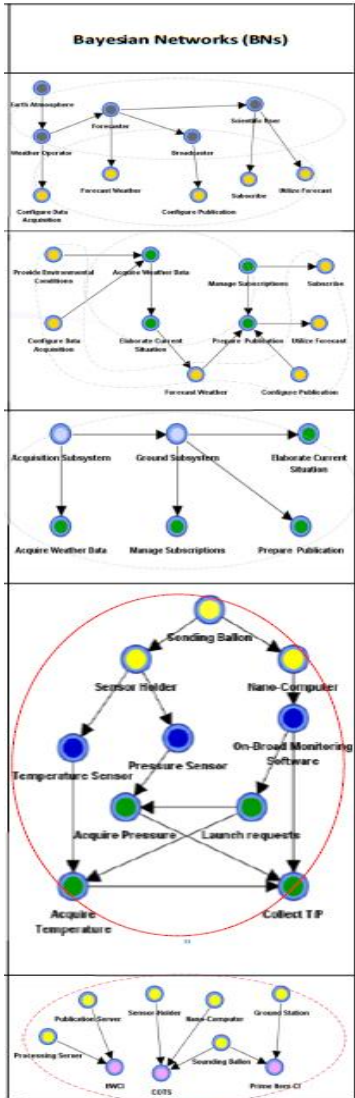


# ORByC

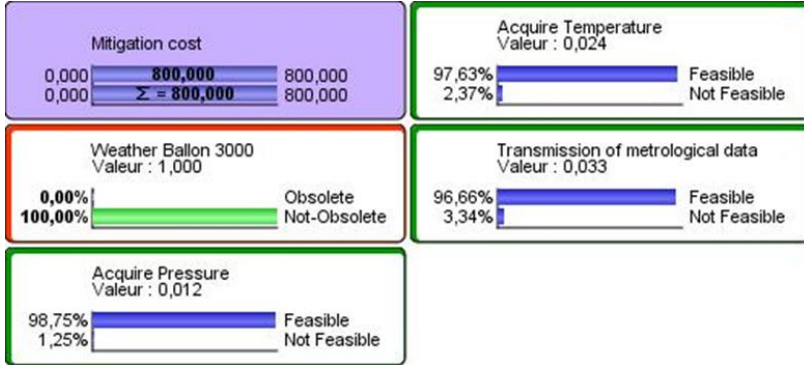
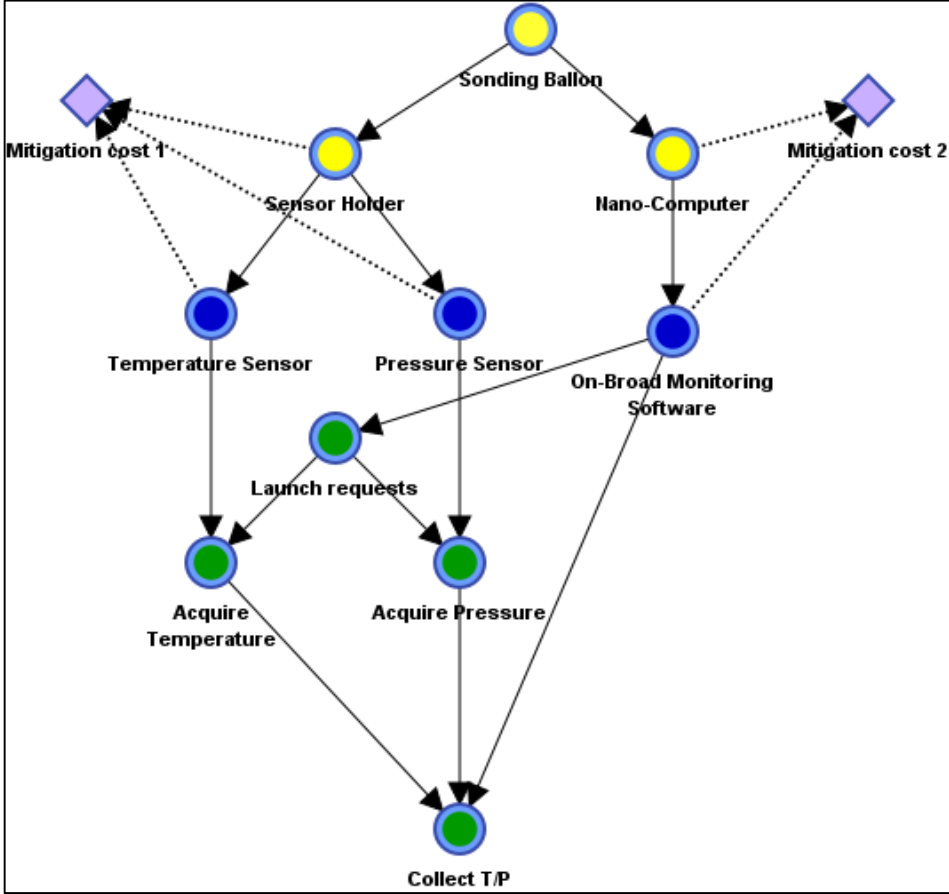
[Soltan,2021]



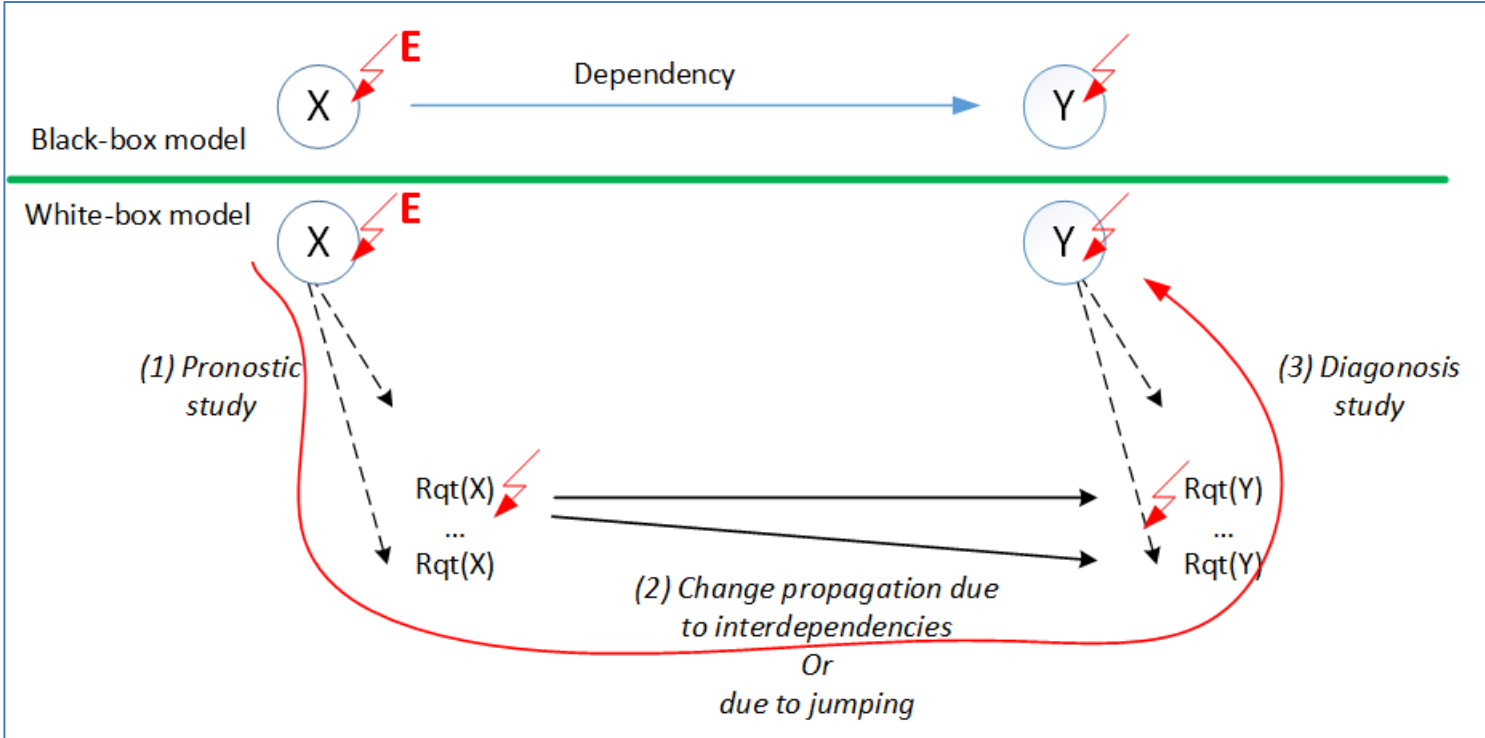
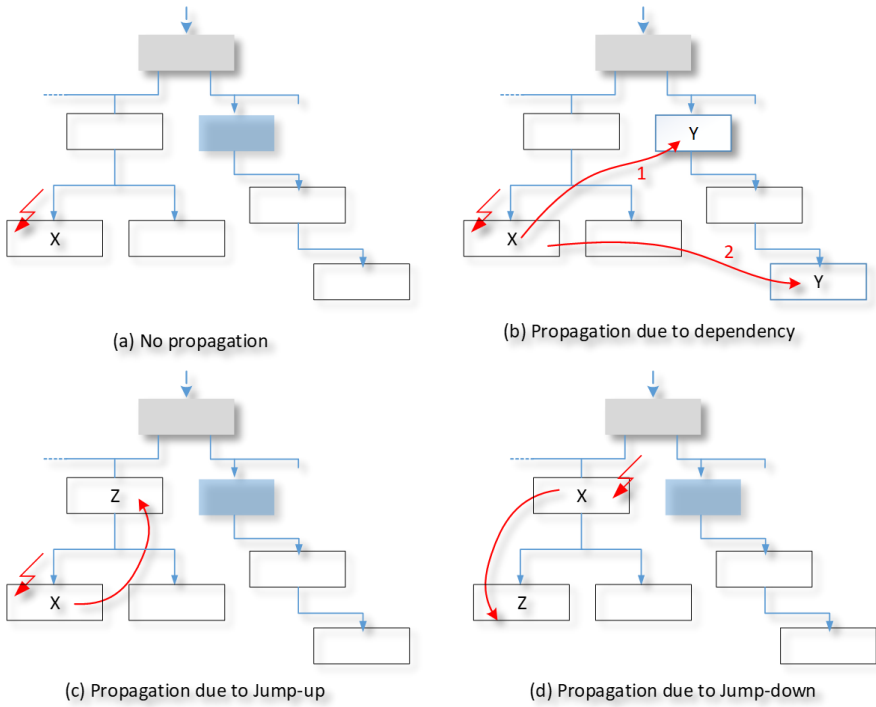
# ORByC: Bayesian network



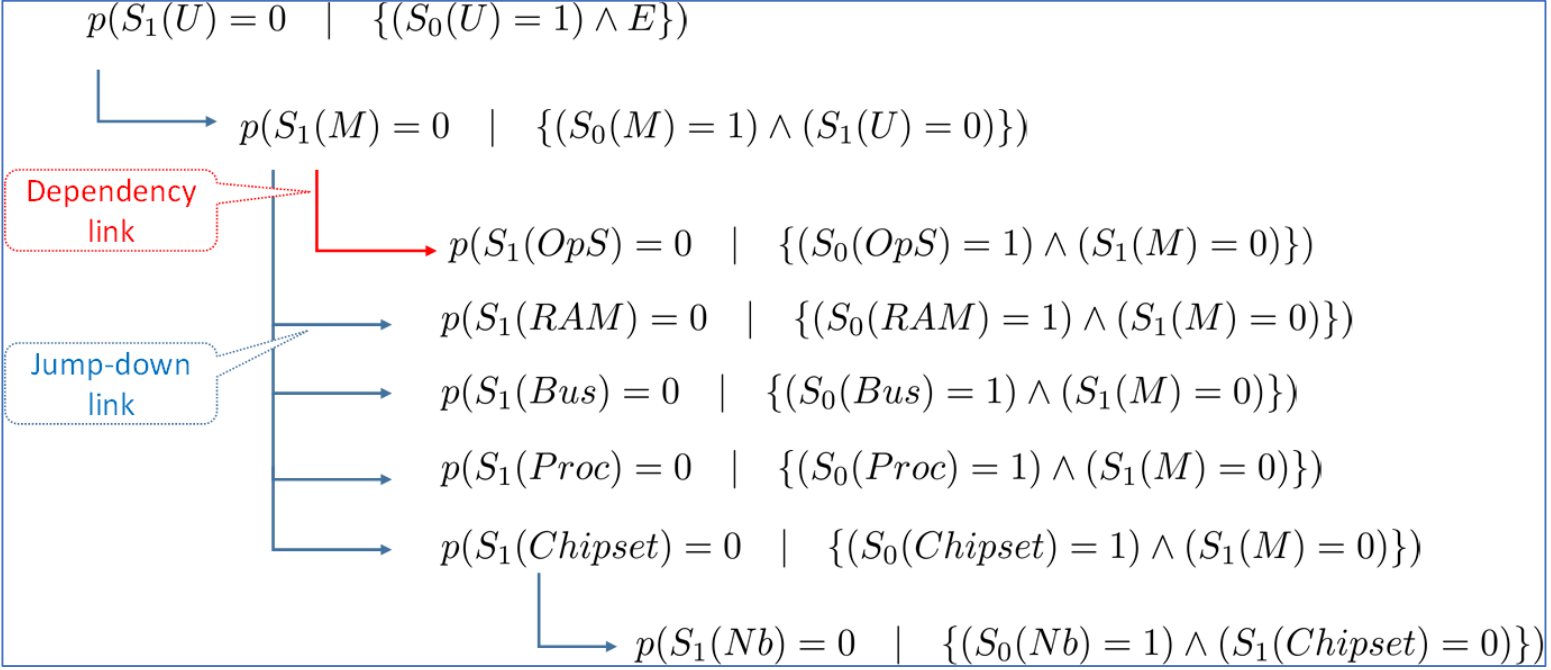
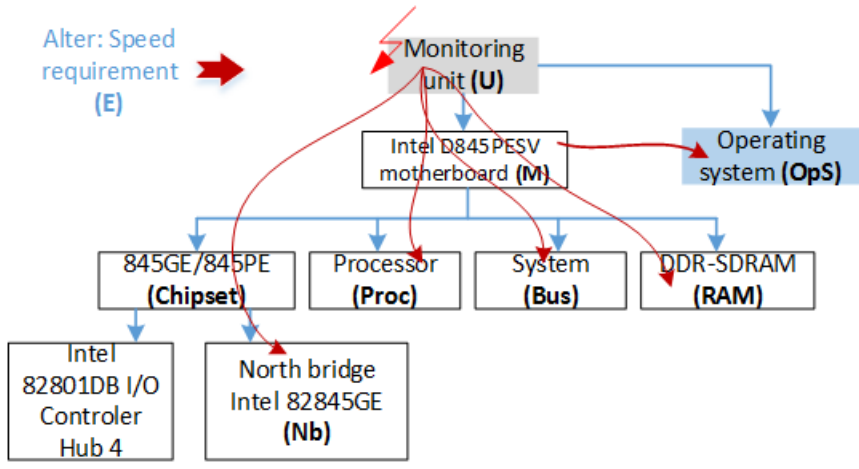
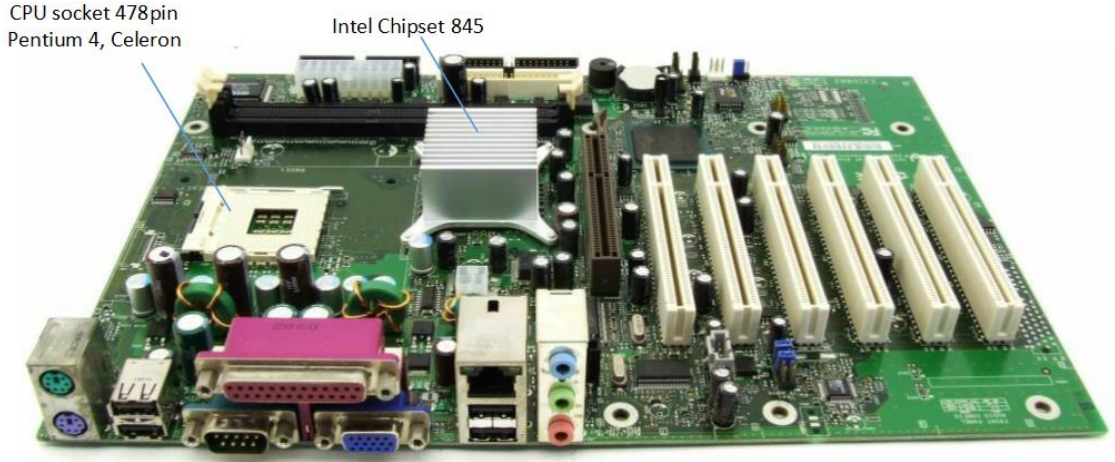
EOLE BN



# Obsolescence propagation [Zolghadri,2021]



# Obsolescence propagation [Zolghadri,2021]



# Publications

## Journal article:

1. Trabelsi, I. Zolghadri, M. Zeddini, B. Barkallah, M. & Haddar, M. Dynamic obsolescence degree prediction: a mathematical formulation. Computers in industry.
2. Soltan, A., Addouche, S. A., Zolghadri, M. A methodology to determine the resilience of a system to obsolescence during the design phase, *submitted to* Research in Engineering Design journal
3. Zolghadri, M. Addouche, S.A. Baron, C., Soltan, A. Obsolescence, rarefaction and their propagation, *submitted to* Research in Engineering Design journal
4. Salas S., Zolghadri M., Vingerhoeds R., Baron C. (TMCE-Special issue), Identification and Assessment of Obsolescence for Complex Systems, *submitted to* Journal of Integrated Design and Process Science

## Peer-reviewed international conferences

1. Soltan, A., Addouche, S. A., Zolghadri, M., Barkallah, M., & Haddar, M. (2021), Design for Obsolescence Resilience. 8th International Conference on Research into Design 7-9 January 2021 IDC School of Design IIT, Bombay, India
2. Soltan, A., Addouche, S. A., Zolghadri, M., Barkallah, M., & Haddar, M. (2021), L'ingénierie des systèmes et les réseaux bayésiens pour la conception résiliente à l'obsolescence, CIGI QUALITA, 2021
3. Trabelsi, I., Zeddini, B., Zolghadri, M., Barkallah, M., & Haddar, M. (2021). Obsolescence Prediction based on Joint Feature Selection and Machine Learning Techniques. In 13th International Conference on Agents and Artificial Intelligence (pp. 787-794). SCITEPRESS-Science and Technology Publications.
4. Trabelsi, I., Zeddini, B., Zolghadri, M., Barkallah, M., & Haddar, M. (2021).Prédiction du degré d'obsolescence en utilisant des techniques d'apprentissage automatique". In the QUALITA 2021 International Industrial Engineering Conference.
5. Trabelsi, I.,M., Barkallah, Zolghadri, M.,Zeddini, B., & Haddar, M. (2021). A New approach to Evaluate and Predict System Obsolescence: Mathematical Formulation. In A3M conference
6. Sophia Salas, Claude Baron, Marc Zolghadri, Addressing Obsolescence from day one in the conceptual phase of complex systems as a design constraint, PLM 2020
7. Trabelsi, I., Zolghadri, M., Zeddini, B., Barkallah, M., & Haddar, M. (2020). FMECA-based risk assessment approach for proactive obsolescence management. In IFIP International Conference on Product Lifecycle Management (pp. 215-226). Springer, Cham.
8. Soltan, A., Addouche, S. A., Zolghadri, M., Barkallah, M., & Haddar, M. (2019). System Engineering for dependency analysis-a Bayesian approach: application to obsolescence study. Procedia CIRP
9. Soltan, A., Addouche, S. A., Zolghadri, M., Barkallah, M., & Haddar, M. (2018). Obsolescence paths through the value chain. Procedia Manufacturing.
10. Boissie, K., Addouche, S-A, Zolghadri, M., Richard D., Longterm storage cost optimization using KoppenG climate classification, DMSMS 2018, Nashville, USA
11. Boissie, K., Addouche, S-A, Zolghadri, M., Richard D., Obsolescence Mitigation in Automotive Industry using Long Term Storage Feasibility Model, TES2018/CIRP, Cranfield, UK

# Thank you !

Questions ?

Contact : [marc.zolghadri@supmeca.fr](mailto:marc.zolghadri@supmeca.fr)