

# Crowd-based safety investigations: the role of ontologies for functional modelling

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M. Sujan<sup>1</sup>, J. Watt<sup>1</sup>, A. De Nicola<sup>2</sup>, M.L. Villani<sup>2</sup>,  
F. Costantino<sup>3</sup>, A. Falegnami<sup>3</sup> & R. Patriarca<sup>3</sup>

<sup>1</sup> Middlesex University (United Kingdom)

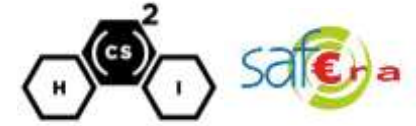
<sup>2</sup> ENEA (ITALY)

<sup>3</sup> Sapienza University of Rome (ITALY)

*Safety-II in Practice workshop  
September, 21-23 2021 (online)*

# ACKNOWLEDGMENT

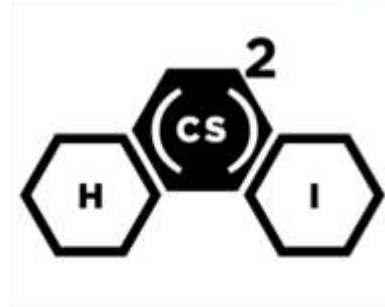
H(CS)<sup>2</sup>I Project (2021)



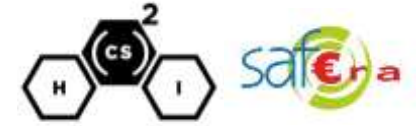
- The following slides are based on ongoing research activities about the Human-Centred Safety Crowd-Sensitive Indicators project (H(CS)<sup>2</sup>I), funded by INAIL and IOSH under 2018 [SAF€RA](#) EU funding scheme.
- The views expressed are ours and do not necessarily reflect the position of the funders.



Human-Centred Safety  
Crowd-Sensitive Indicators



# FOUNDATIONS: THE FRAM



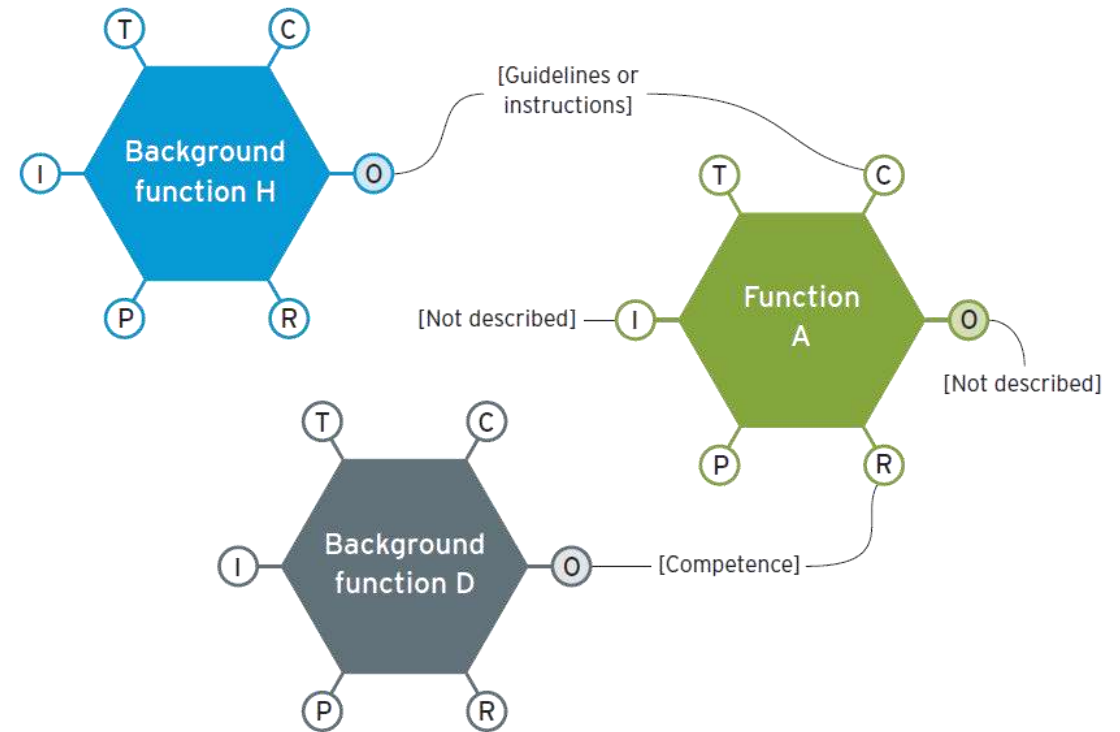
## FRAM 4 principles

Equivalence of successes and failures

Approximate adjustment

Emergence

Functional resonance

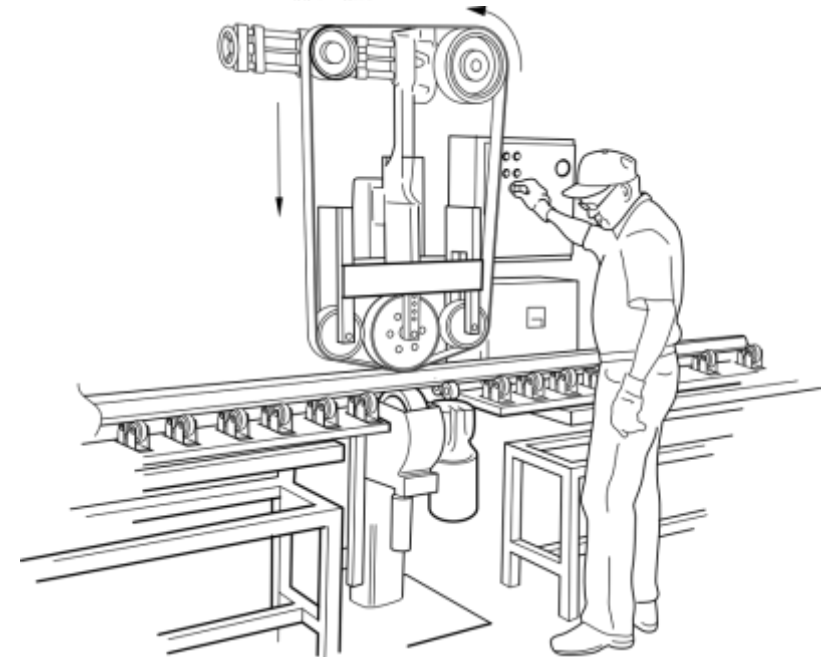
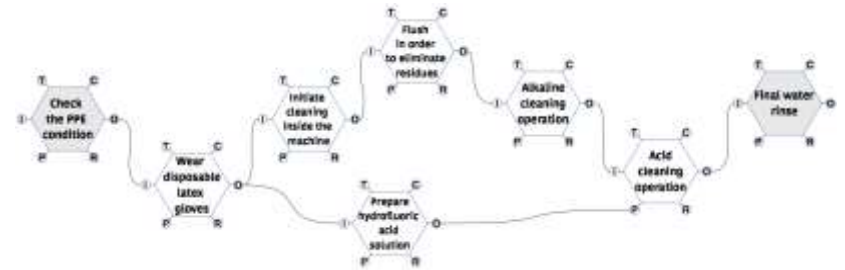
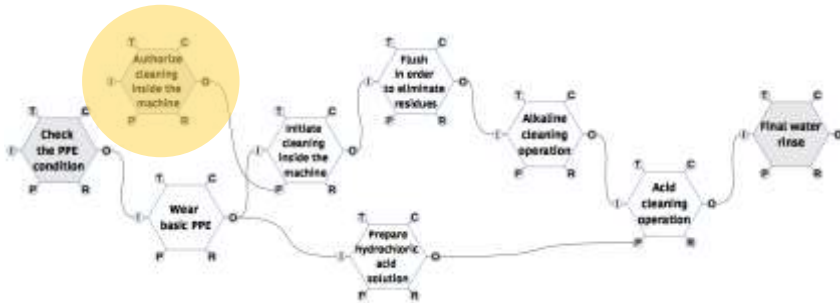


# FOUNDATIONS: WAI vs WAD

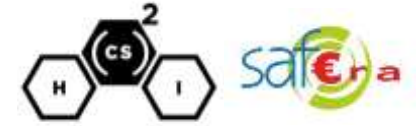


**Work-As-Imagined**  
(at the blunt end)

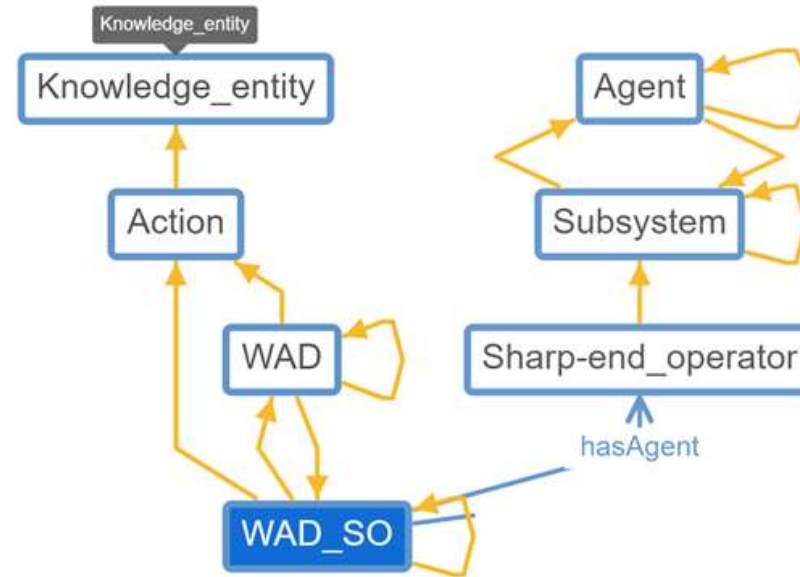
**Work-As-Done**  
(at the sharp end)



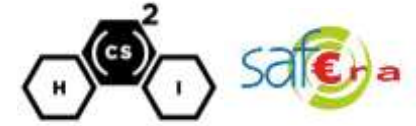
# FOUNDATIONS: ONTOLOGIES



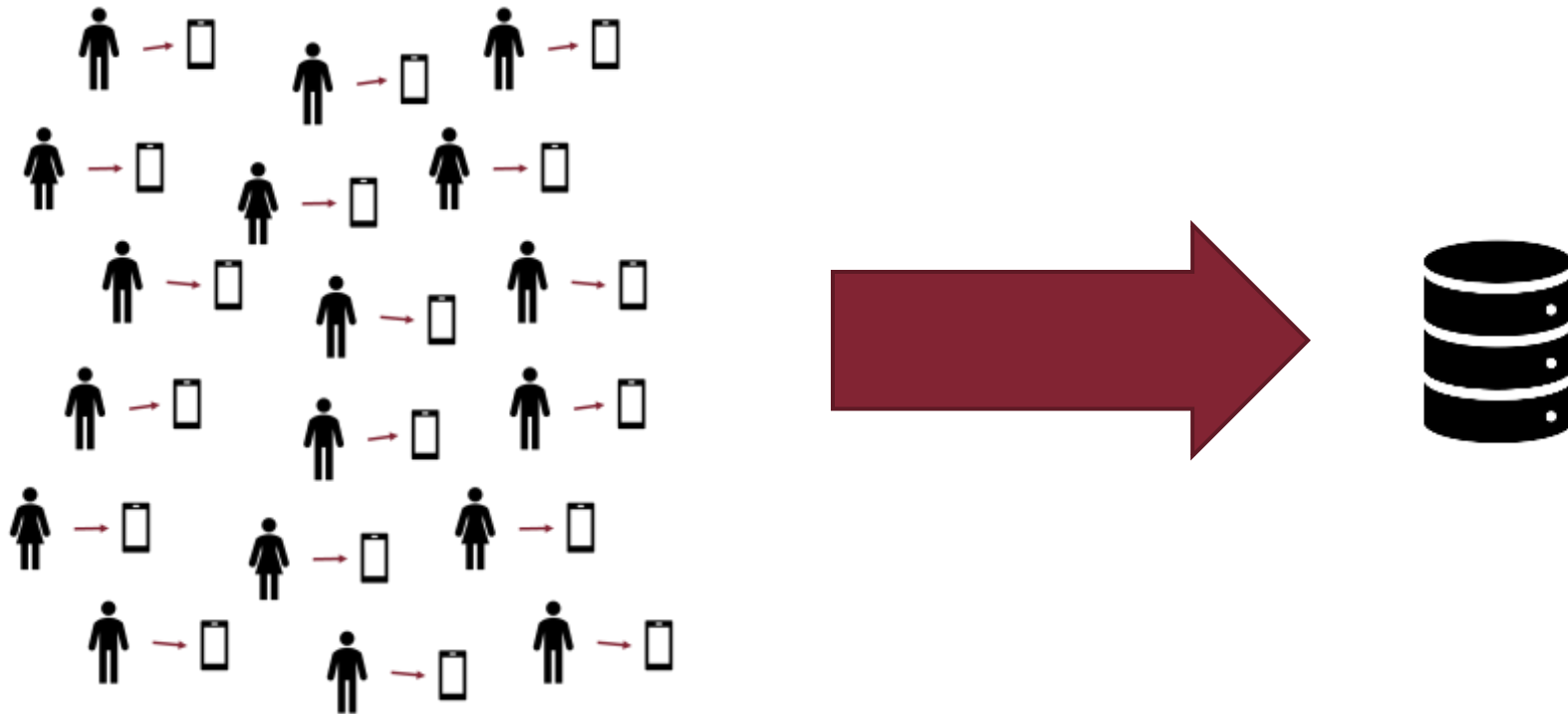
Specialized computer data structures to give formal representation of category, properties and relations between data concepts and entities on a certain domain



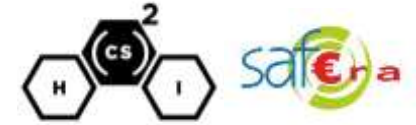
# FOUNDATIONS: MPCS



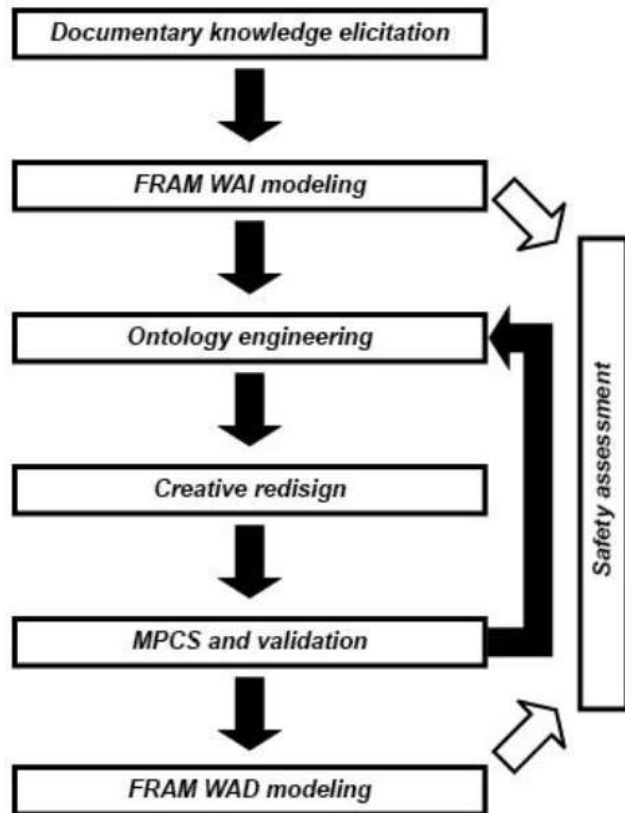
**Mobile Participatory Crowd-Sensing** is a data collection mechanism for gathering context-specific information directly from sharp-end operators, through a mobile app that gives his/her actual work activity.



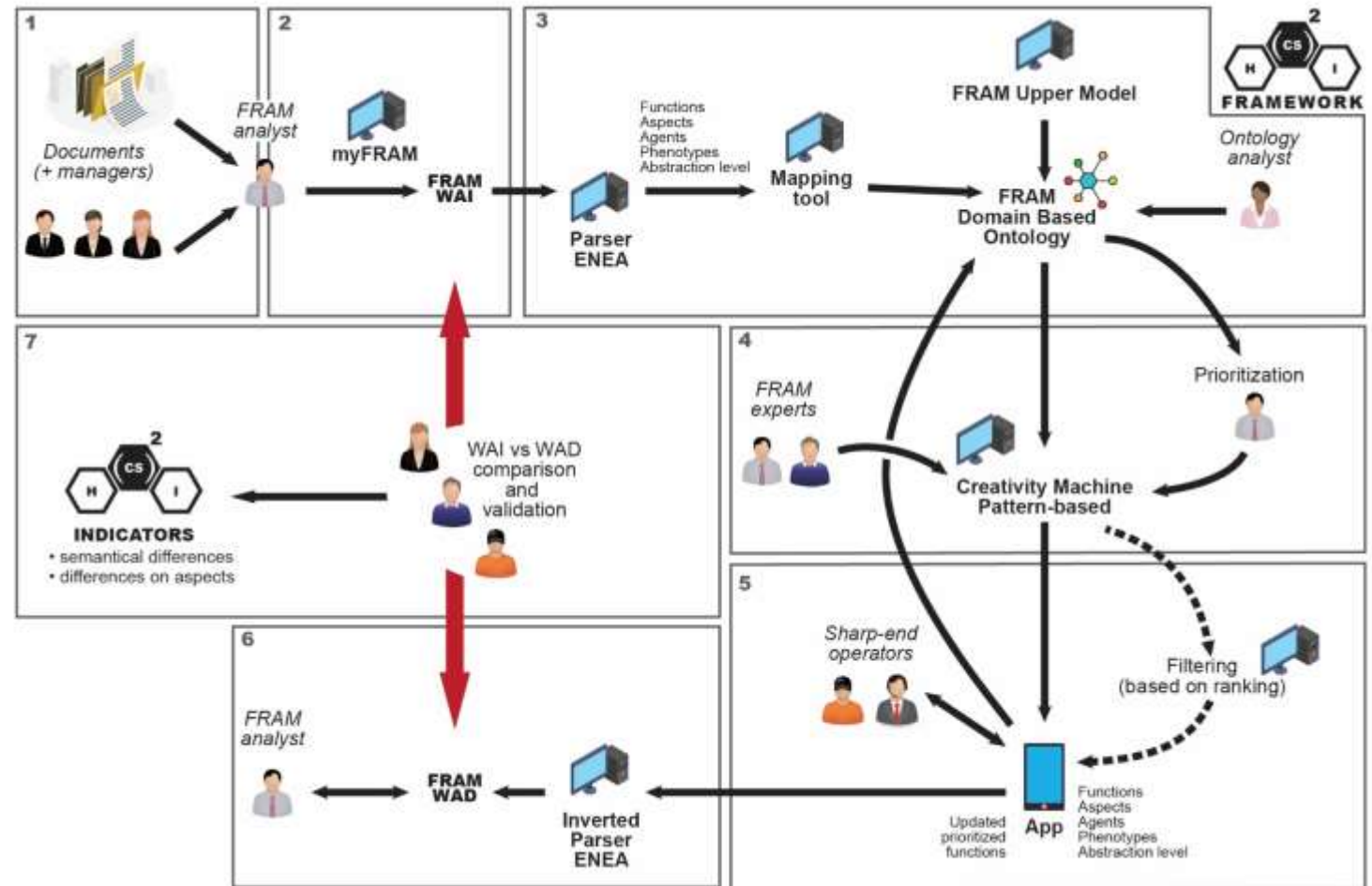
# H(CS)<sub>2</sub>I METHODOLOGY



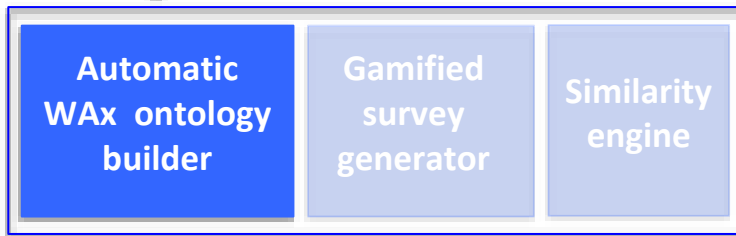
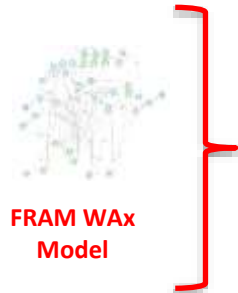
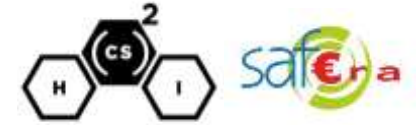
*At an abstract level*



*At a more granular level*



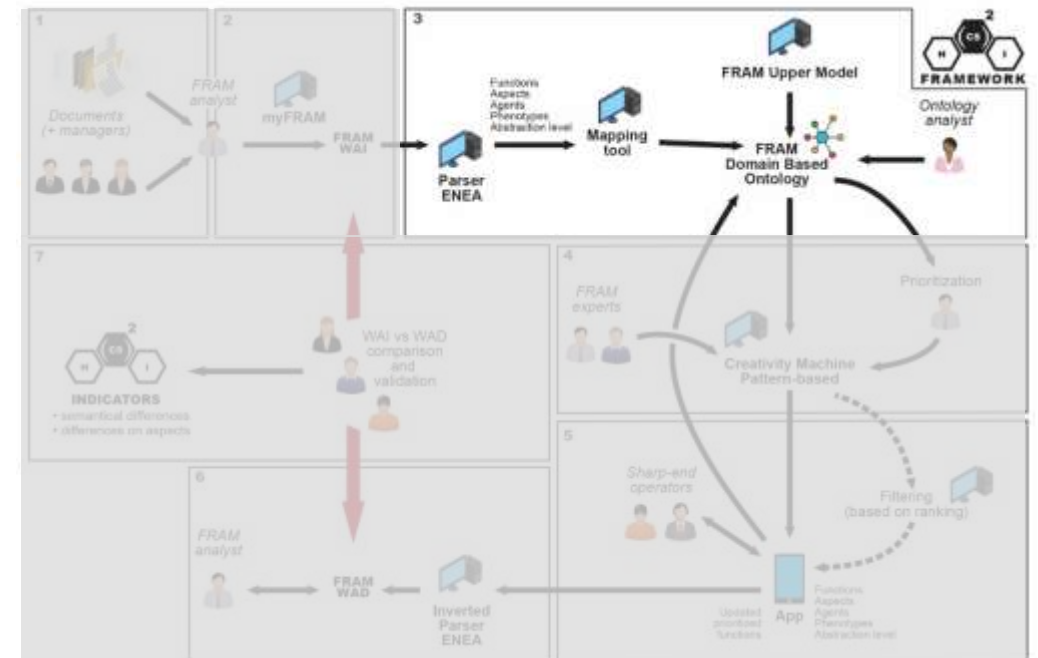
# METHODOLOGY (FOCUS ON ONTOLOGIES)



**CREativity Machine**

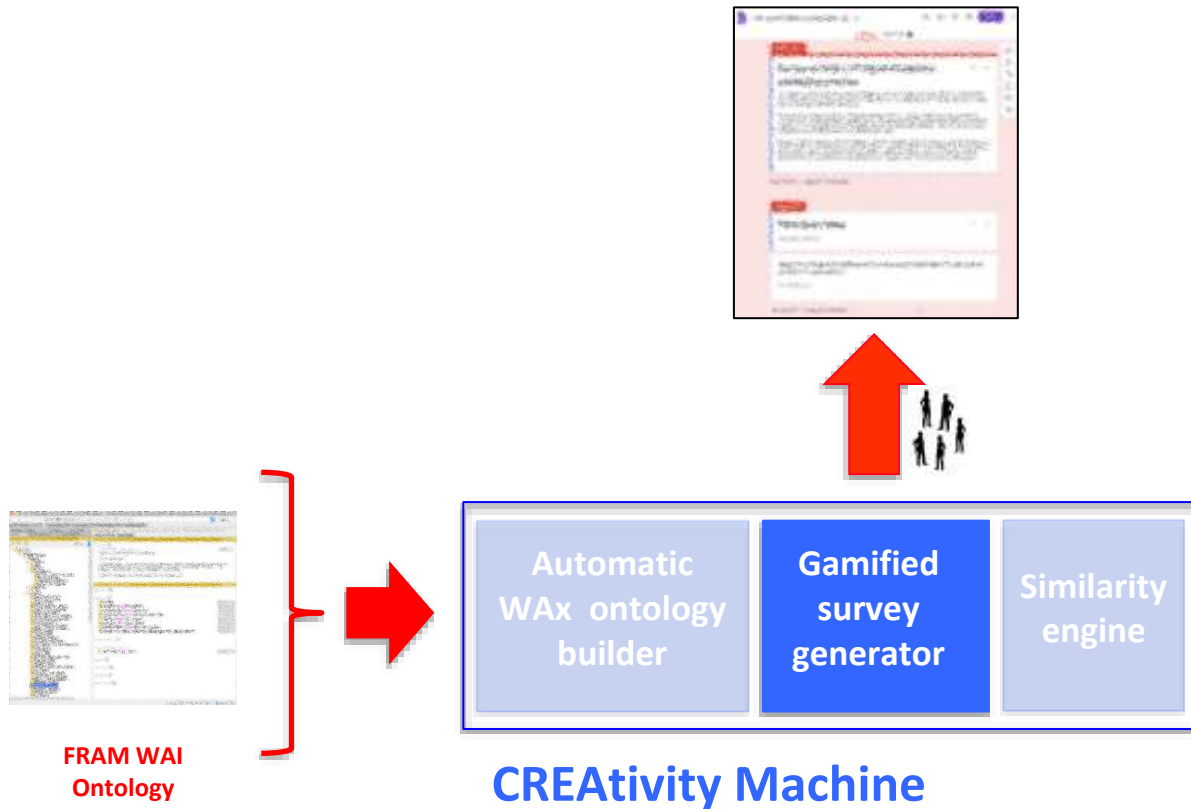
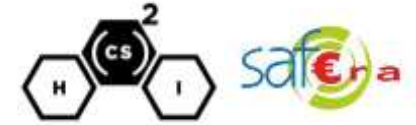
## Semantic services

- Ontology building/enrichment from Wx models
- Patterns-based generation of questionnaires to elicit WAD knowledge (starting from WAI knowledge)
- Semantic comparison between WAI and WAD models



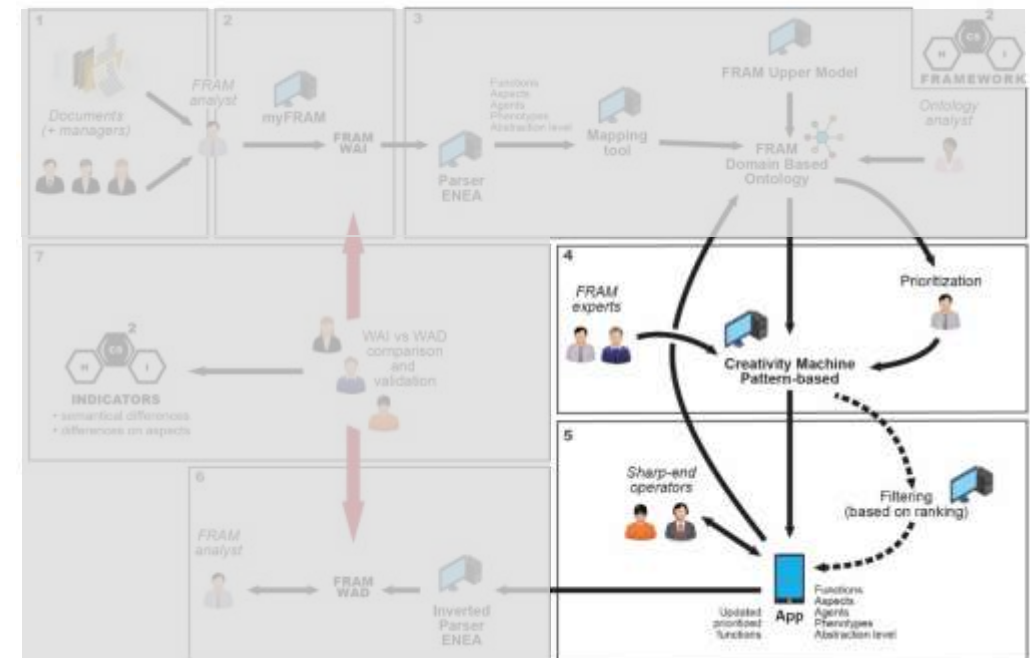


# METHODOLOGY (FOCUS ON ONTOLOGIES)

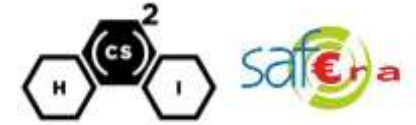


## Semantic services

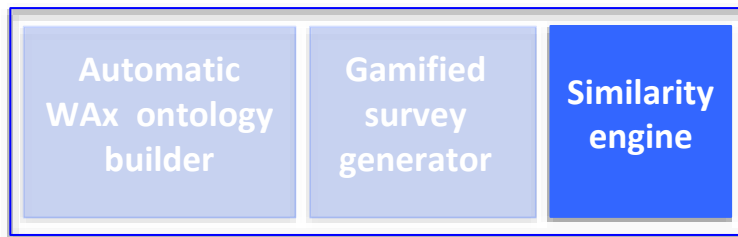
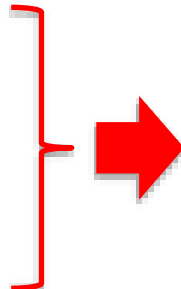
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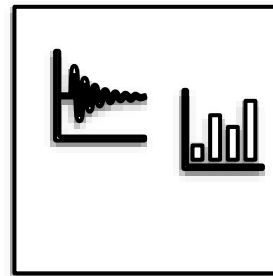
# METHODOLOGY (FOCUS ON ONTOLOGIES)



FRAM Wx  
Ontology  
(including WAI  
and WAD  
knowledge)



CREativity Machine

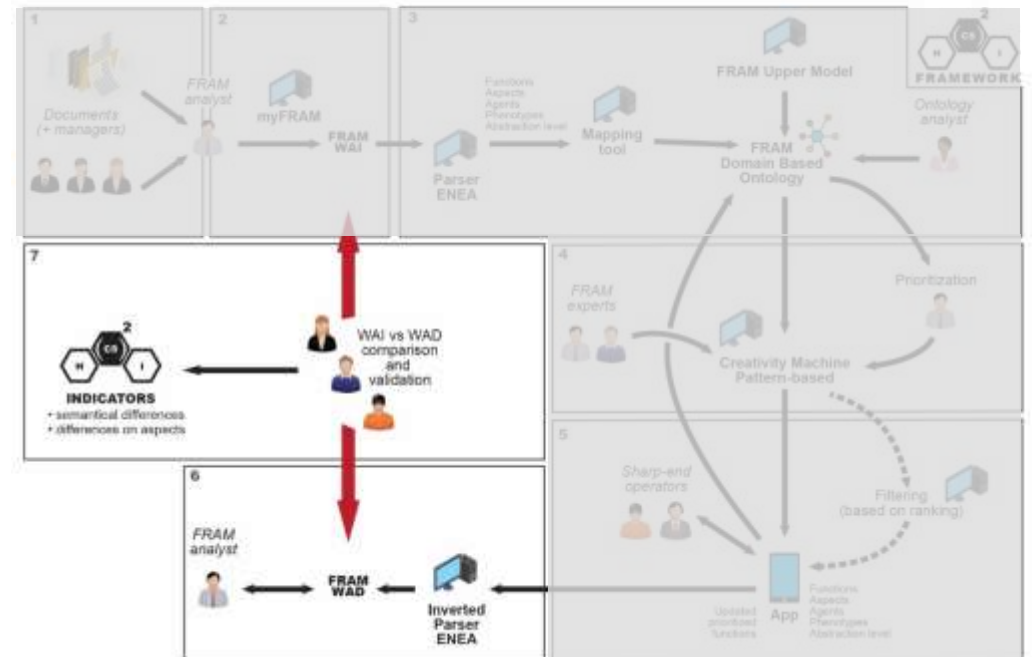


Report



## Semantic services

- Ontology building/enrichment from Wx models
- Patterns-based generation of questionnaires to elicit WAD knowledge (starting from WAI knowledge)
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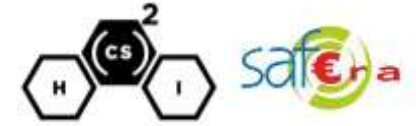


A grayscale photograph of a pharmaceutical manufacturing plant. Two workers in full cleanroom suits are visible, working with large stainless steel tanks and machinery. The background shows a complex network of pipes and equipment. The image is overlaid with a semi-transparent dark gray layer, and the text is centered on this layer. The overall color scheme is dominated by the dark gray of the overlay and the yellow of the text.

# CASE STUDY

A MULTI-NATIONAL PHARMACEUTICAL COMPANY

# FIRST STAGES



## PHASE 1



Documental  
studies

## PHASE 2



Semi-structured  
Interviews (30 min each)

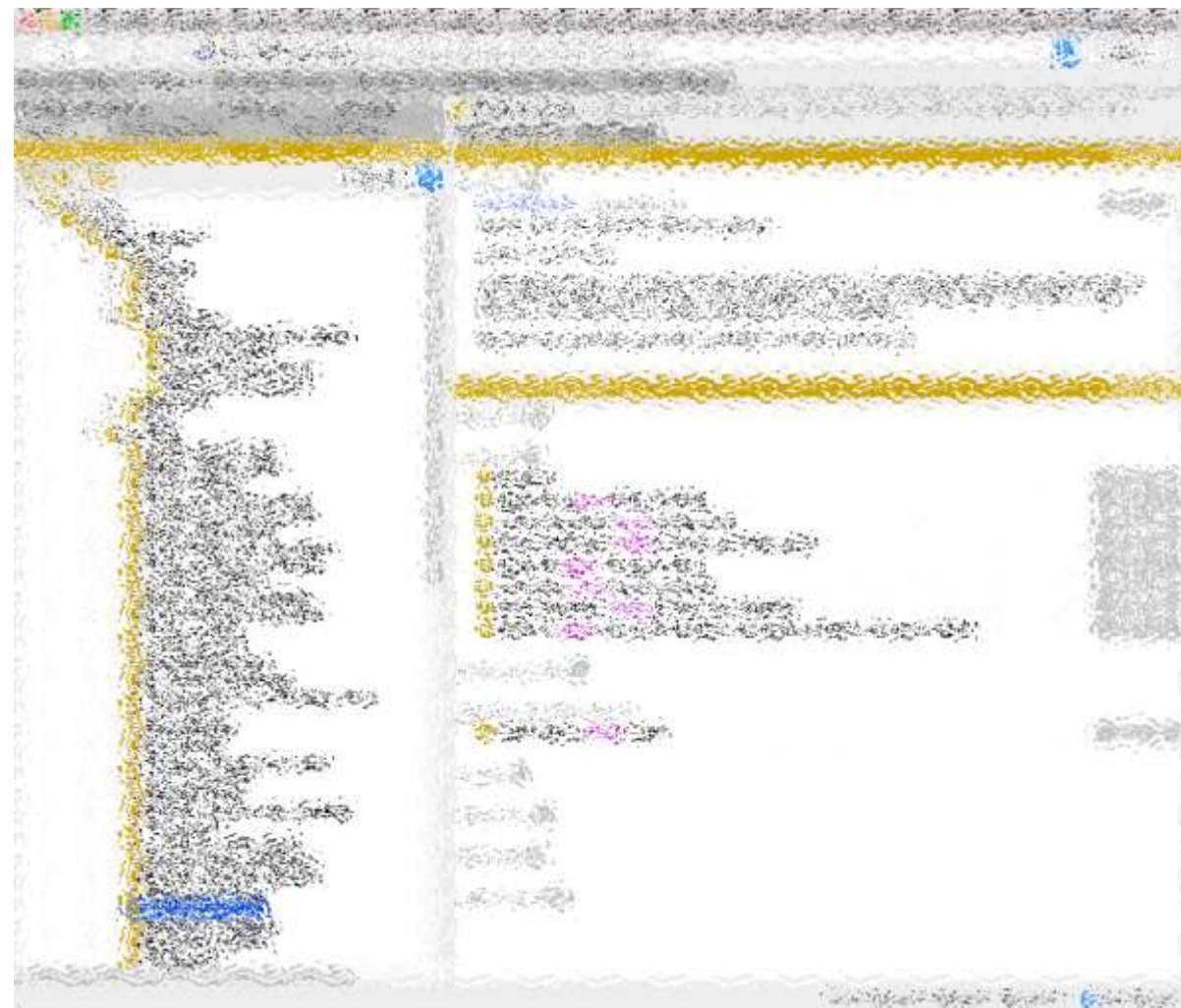
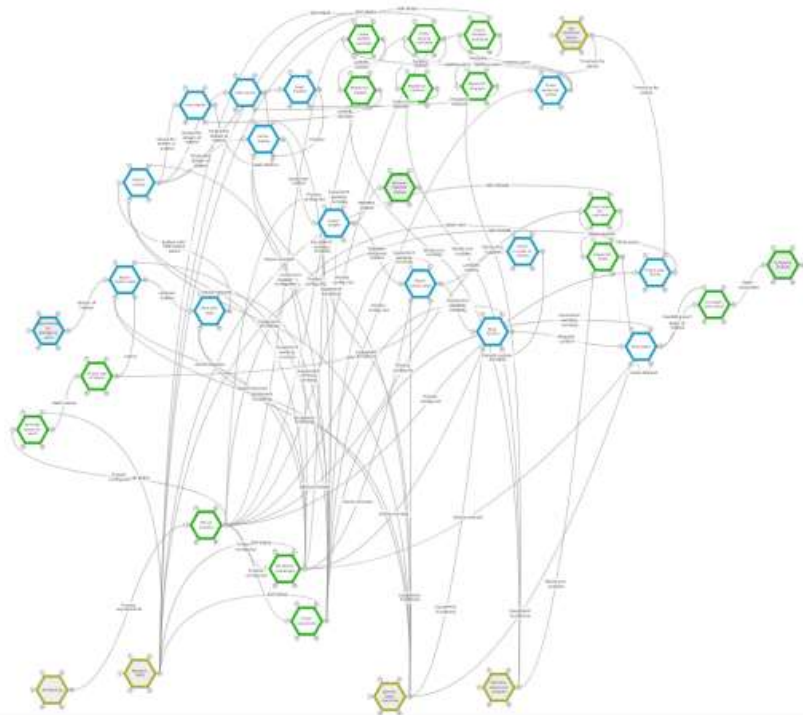
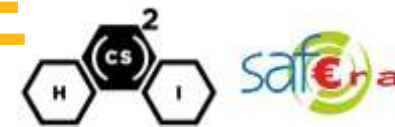
## PHASE 3



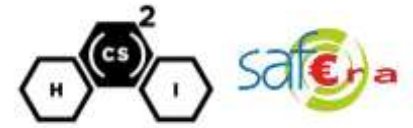
Focus Groups  
(60 min each)

# SEMANTIC LIFTING of **WAX** KNOWLEDGE

H(CS)2I Project (2021)



# FRAM MODELLING

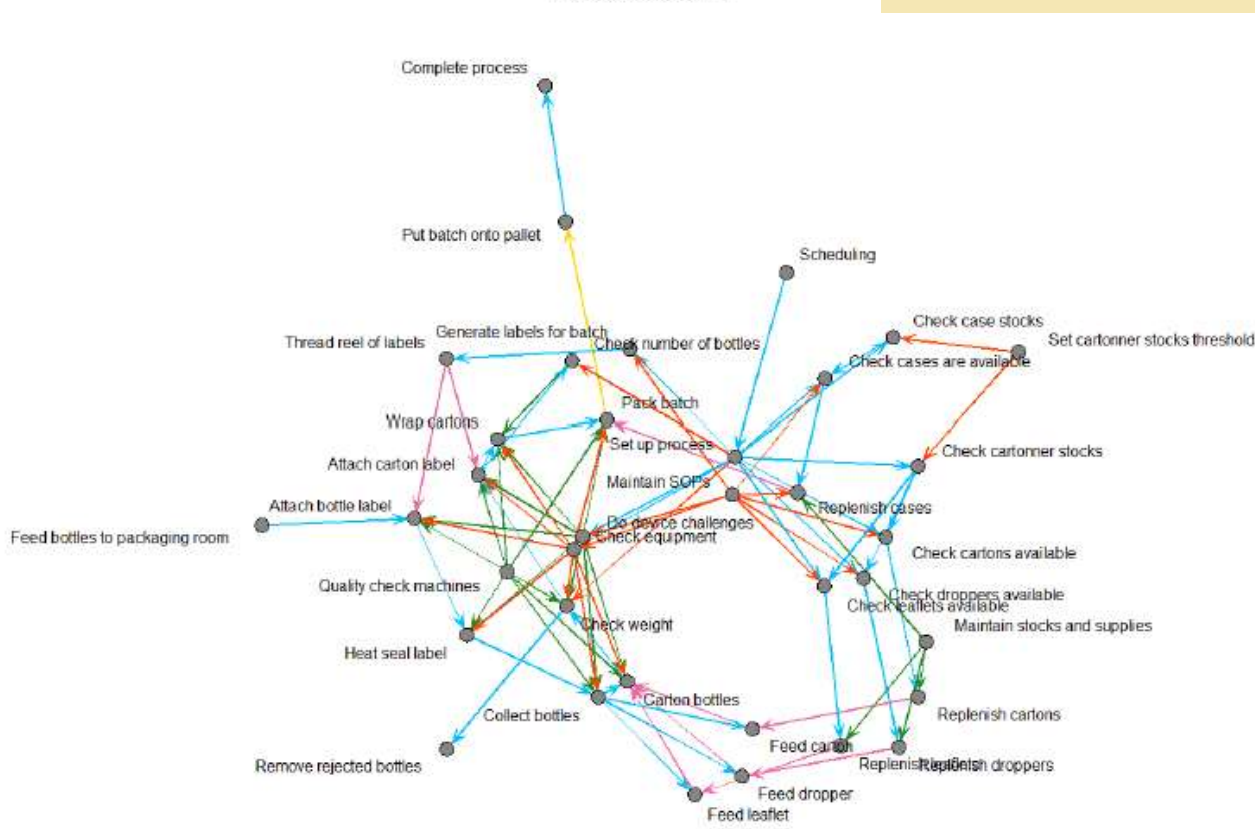


**Work-As-Imagined**  
(at the blunt end)

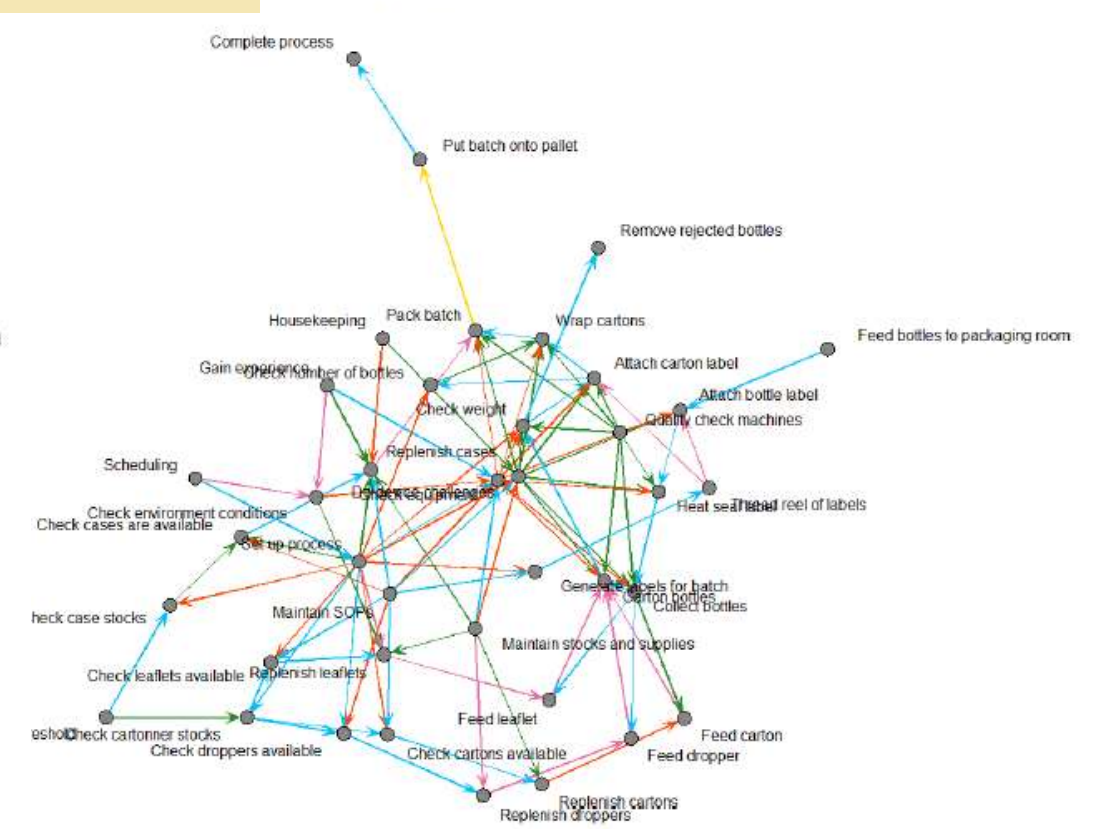
*Differences appear in functions, and aspects, showing systematically where WAD diverges from WAI*

**Work-As-Done**  
(at the sharp end)

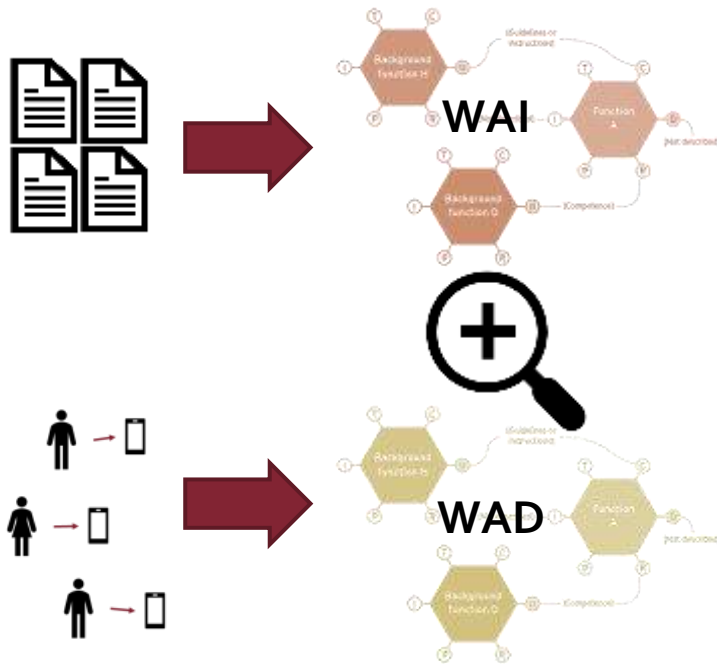
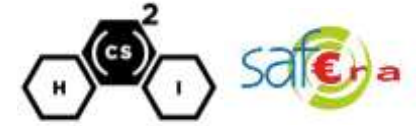
Work\_As\_Imagined



Work\_As\_Done



# RESULTS (excerpt)

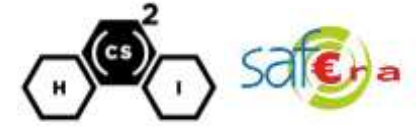


List of critical functions and aspects

## List of indicators (excerpt)

- **Function:** Check environment conditions  
**Aspect:** Alert on rejects  
**I7 = Frequency of reported cues/frequency of rejected batch**
- **Function:** Check environment conditions  
**Aspect:** Change on sounds  
**I2 = % of correct identification of sound changes**  
*Note that this indicator might be used to address specific training actions; sounds could also be recorded to facilitate training, and allow operators recognizing them in actual operations.*

# GROUP DISCUSSION



- How much do you consider valuable the purpose of the research for safety management?
- Which are the strengths and weaknesses of the proposed participatory approach?
- Any suggestion for future digitalization of the methodology? (see mock-up for data gathering attached)
- ...Any suggestion?





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