Workshop #5
How to integrate Human and Organisational Factors in railway investigations?

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European Rail Safety Days 2021, Porto

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The objective is to share with you:

- *some of the content and approach of one of the new trainings on Human and Organisational Factor (HOF)*
- *how the integration of HOF into the safety management system (SMS) can be facilitated from an investigator's perspective*
- *However…*
  - ***in less than 1 hour, it is a big challenge for me to explain two models supporting HOF integration,***
  - ***in a more systemic investigation, and make it an exercise!***
  - ***So I propose to "show you" with little explanation, to make an intuitive experiment all together. Are we all still volunteers…?***

With quick but powerful exercises. Your feedback is all welcome! *fabrizio.carpinelli@era.europa.eu*

How to reach this objective together?

1. Only the **analysis** part of the investigation process
2. The **real case** for this workshop
3. Facing with it: what do **you decide**?
4. The **timeline** and the critical variabilities
5. Introducing a pragmatic model for questioning HOF – **HOF 5x5**
6. What are the **sources of the critical variabilities**?
7. Introducing a structured model to investigate the SMS – **SAFRAN**
8. Recommending to **develop organisational learning**
9. Conclusion & feedback

EXERCISE-EXPERIMENT!

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1. Only the analysis part of the investigation process

Learning from accidents and incidents

(Lindberg et al., 2010)

Initial reporting. All events that are plausible candidates for in-depth investigation should be reported – in sufficient detail to decide whether an investigation should take place.

Selection. The events selected for in-depth investigation should be those from which as much information as possible can be extracted that is useful for preventive work.

Investigation. The procedures and methodologies for investigation are constructed to provide information that is as useful as possible for prevention of future accidents.

Dissemination of results. The investigation results are distributed to all those who can use them to prevent future accidents.

Preventive measures. The information from event investigations is used to prevent future accidents.

Evaluation. The safety information sharing process is regularly evaluated, and it is itself improved through experience feedback

A common accident investigation approach

(Wienen et al., 2017)

a. Find all events that have a causal relationship with the accident

b. Describe the history of the accident by linking these events

c. Find all conditions that enabled these events, including events that lead to those conditions

d. Identify components, feedback mechanisms and control mechanisms that played a role during the development of the accident

e. Identify at which point the accident could have been prevented and analyse if this can be generalised

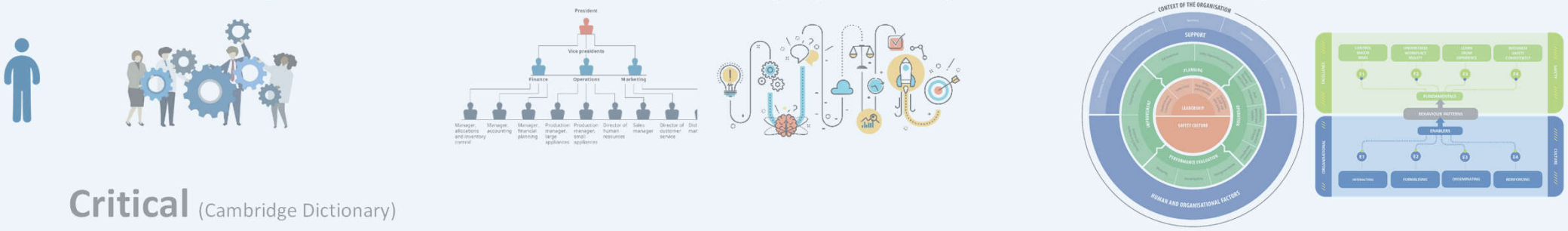
f. Draw conclusions and propose improvement actions

ANALYSING?!

HOF (International Ergonomics Association)

- **"ergonomics (or human factors) is the scientific discipline**
- **concerned with the understanding of interactions among humans and other elements of a system,**
- **and the profession that applies theory, principles, data, and other methods**
- **to design in order to optimize human well-being**
- **and overall system performance".**

The term **'organisational'** has been introduced to highlight the organisational level of analysis



Critical (Cambridge Dictionary)

- (B2) « **Of the greatest importance to the ways things might happen** »
- Synonyms (in our context): Meaningful, salient, life-changing, impactful, **pivotal**

Variability

- **" the quality or fact of being variable (= likely to change often) "** (Cambridge Dictionary)

Expected or unexpected, positive or negative, deviation from what is planned or prescribed

extract from training

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2. The real case for this workshop

A few centimeters of luck

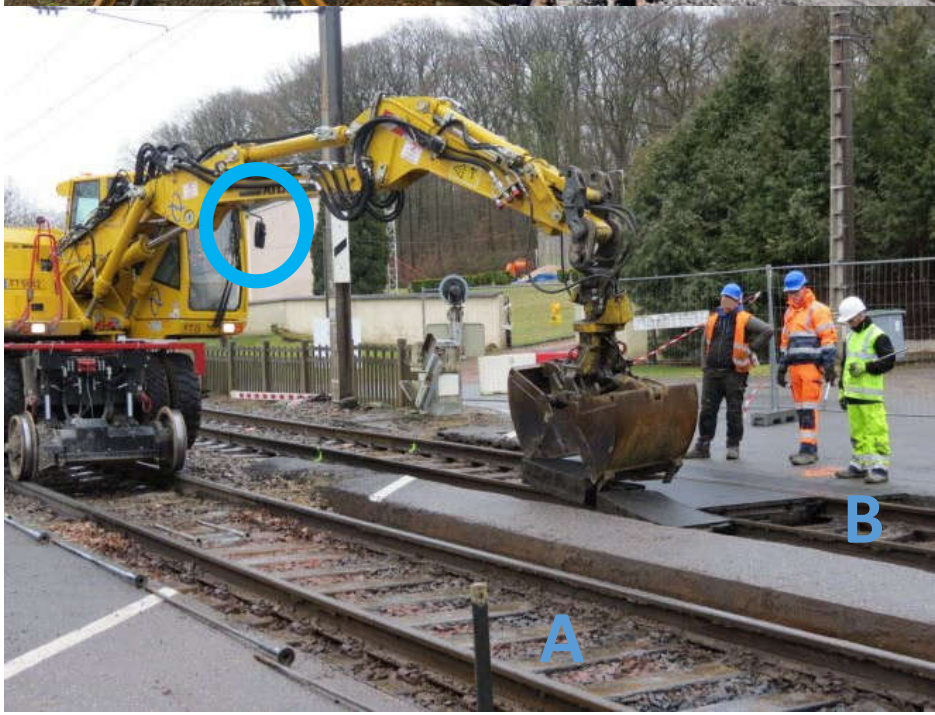
03 November 2017, Belgium, Blaton

- Level crossing modernisation, 2 tracks, traffic maintained

➢ **A train (19th) hits the crane's mirror**

- **Local work protected by a formal procedure**
  1. Crane operator CO dismantles track **A**
  2. A train passes occasionally on track **B**
  3. Another worker W1 who remains near the crane receives a request from W2 (responsible for the work on site) to free the gauge, and communicates it to CO
  4. Once the gauge is made free, W1 communicates it to W2
  5. W2 confirms to the TCR (traffic control room), which allows the train to pass

➢ **It was a hot one! No consequences at all…**



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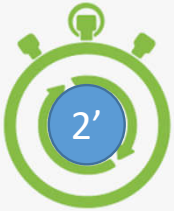
2. The real case for this workshop

Do you decide on investigating it or not?

- Taking into account the limited resources to investigate, the continuous trafic operations, the no-consequences…
  What do you think the local management did?
  - CO failed to free the gauge
  - but he was in the right alignment and position
  - Written declarations were made, CO was replaced, works continued, a few minutes delay given, no damages

- **Will you recommend/decide something?**
  Plenary



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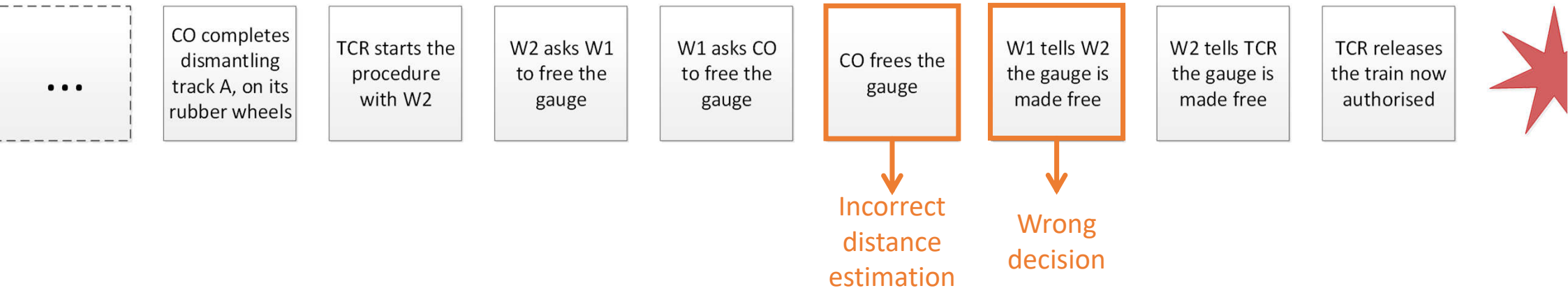
4. The timeline and the critical variabilities

CO: Crane Operator
W1: Worker staying near the crane
W2: Worker responsible
TCR: Trafic Control Room operator

What are the critical variabilities?



- **A classical series of WHY?...**
  (how to prevent this to happen again?)

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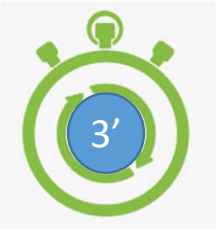
4. The timeline and the critical variabilities

- What are the critical variabilities?
- What are the SOURCES OF the critical variabilities?

- How to distinguish between them?

How can we better explore the HOF to analyse the relevant interactions ?

Discussion in group

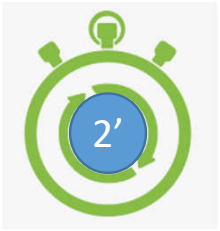


1. What **do you see**… in terms of HOF?

Post – it notes: KEYWORD(S) UPPERCASE

5. Introducing a pragmatic model for questioning HOF: HOF 5x5

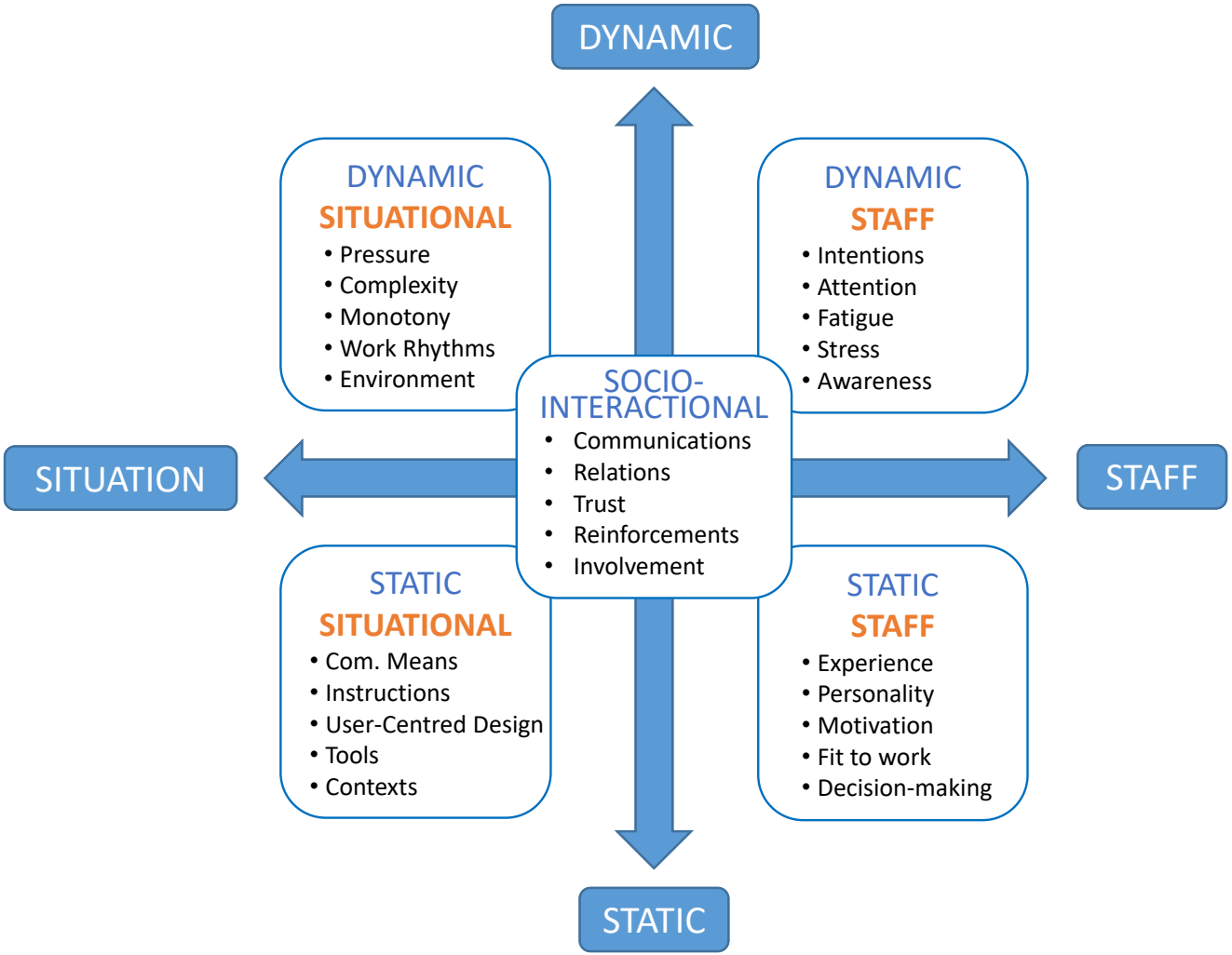
Discussion in group



2. What you **don’t see**… in terms of HOF?

Post – it notes

5. Introducing a pragmatic model for questioning HOF: HOF 5x5



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5. Introducing a pragmatic model for questioning HOF: HOF 5x5

DYNAMIC STAFF FACTORS	temporary characteristics of the individuals and teams that have influenced the course of a situation
STATIC STAFF FACTORS	lasting characteristics, repetitive elements in the concerned individuals and teams that have influenced the situation or other concerned people
DYNAMIC SITUATIONAL FACTORS	temporary or even fugacious characteristics of the situation that have influenced (or could influence – if the questioning is used in a proactive approach) the individuals and the teams
STATIC SITUATIONAL FACTORS	lasting or repetitive characteristics of a situation that have influenced the individuals or teams at work, or the context in which the activities take place
SOCIO-INTERACTIONAL FACTORS	relationships between the people concerned and around them that have influenced the work situation or the people themselves in their reactions, attitudes, perceptions

extract from training

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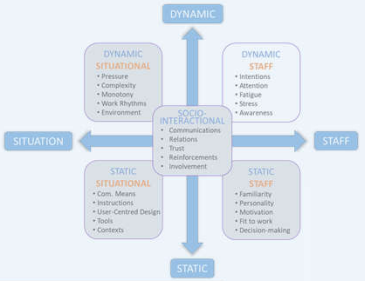
INTENTIONS: Intentions during actions / Situational reasoning / Error types



- Definition

DYNAMIC STAFF FACTORS	temporary characteristics of the individuals and teams that have influenced the course of a situation

Understand the persons' **Intentions**

- which in the situation (hic and nunc) motivated them to decide and act as they did
- as well as the type of the variability they produced
- punitive attitude (or perceived) is replaced by an interested curiosity aiming at continuous improvement

Questioning this factor should refer to three aspects:

- intention during the actions (e.g. what we wanted to do, to achieve, for what purpose, by avoiding what)
- reasoning in a situation (e.g. in function of what the person(s) had imagined the situation)
- the correct understanding of the type of variability (e.g. (in-) voluntary, type of error, type of violation)

extract from training

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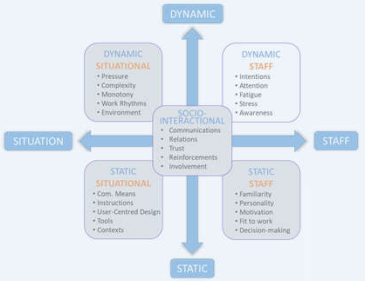
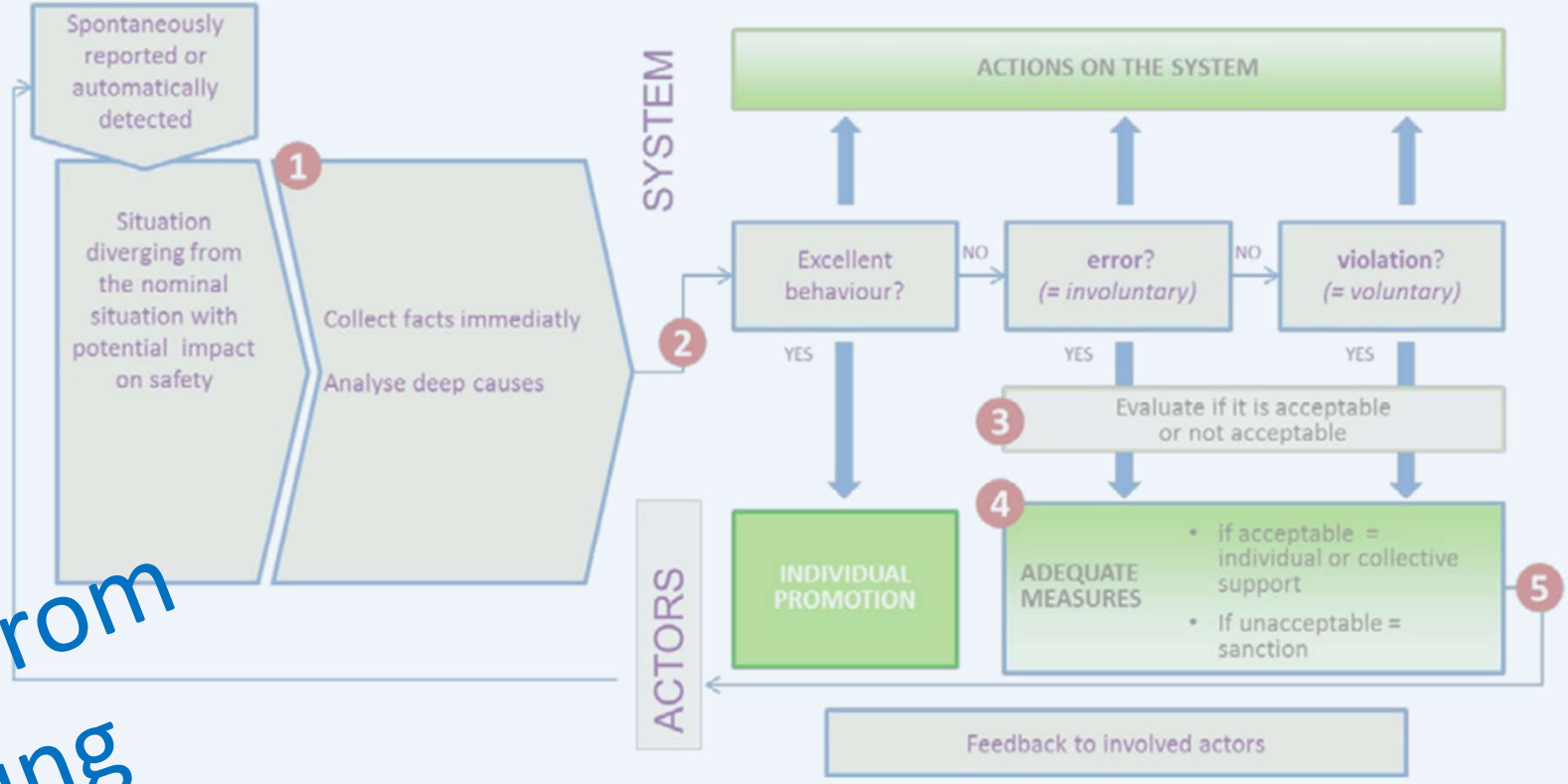


- Illustration

Practical case: a process implemented at SNCF



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INTENTIONS: Intentions during actions / Situational reasoning / Error types

Exercise 1.

What kind of activities can this factor influence? And give an example of safety occurrence?

Exercise 2.

Which processes, functions or activities can influence this factor?

Exercise 3.

Create a set of questions you will ask about this factor to check it…

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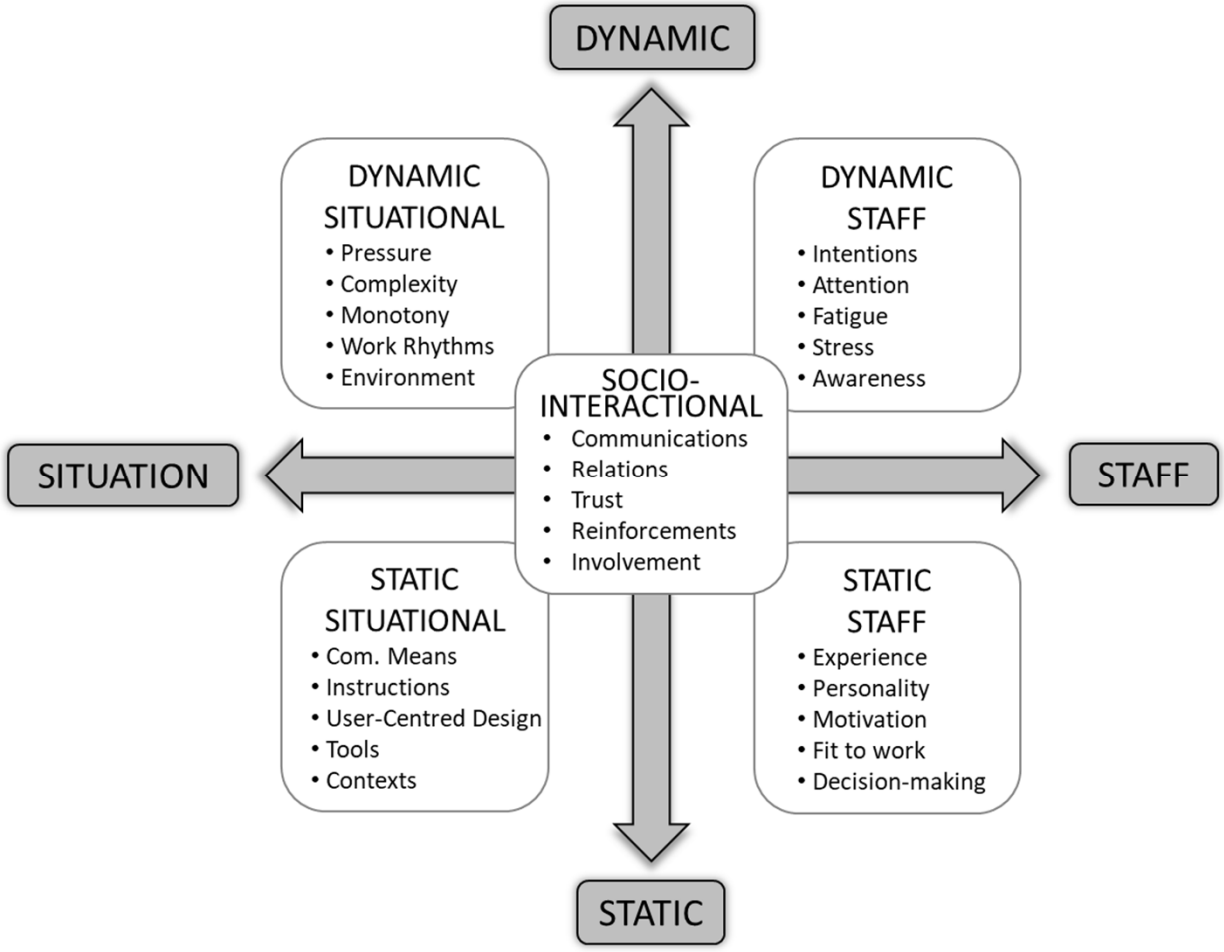
5. Introducing a pragmatic model for questioning HOF: HOF 5x5



6. What are the sources of the critical variabilities?

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CO: Crane Operator
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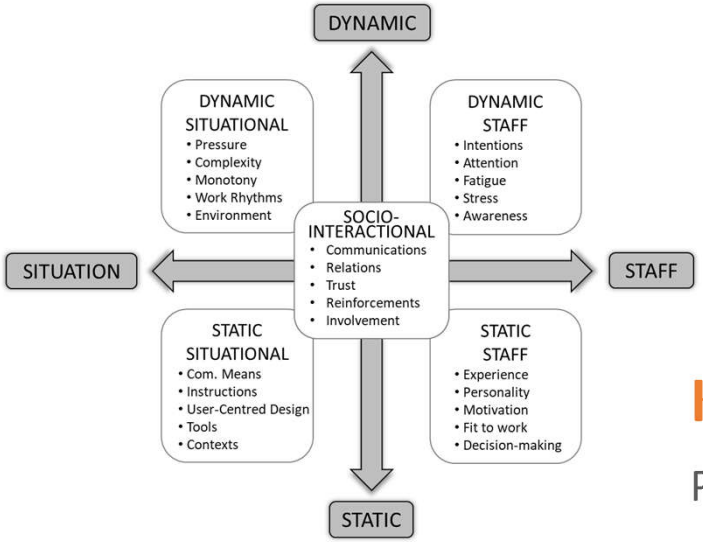
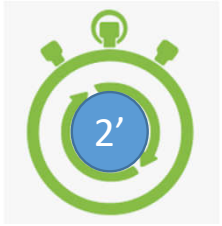


KEYWORDS on the sources of variabilities?

Plenary



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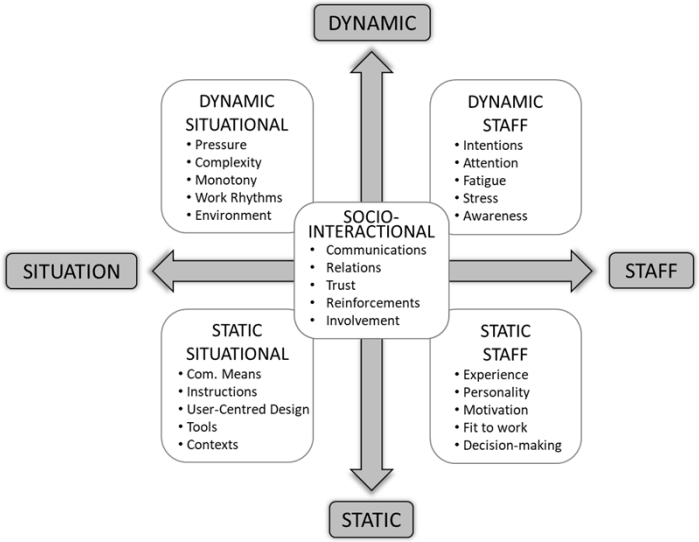
Incorrect distance estimation

Wrong decision



QUESTIONING

Pressure
Monotony
Awareness
Communications
Instructions
User-Centred Design
Tools
Fit to work
Decision-making

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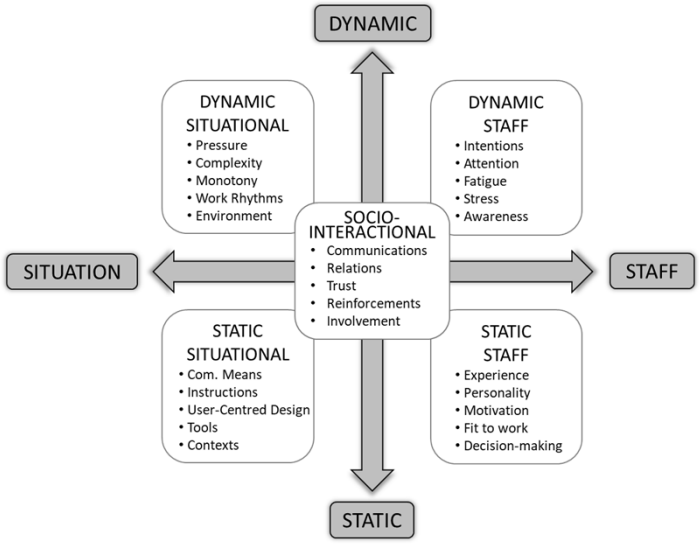

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How can we better explore the system in place to manage the sources of variability and their monitoring?

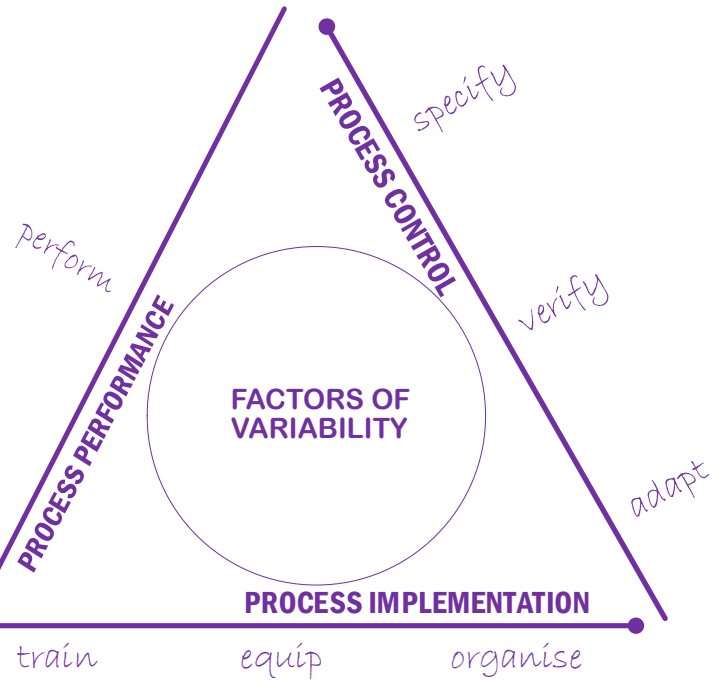
7. Introducing a structured model to investigate the SMS
A model of a risk-based system

Each process, function, group of activities has to be:

- specified, verified, adapted, ensuring a sustainable control of risks related to all activities in possibly and most probably a changing context: "doing the right things" **= PROCESS CONTROL**
- provided with the right resources and means, planned and organised to ensure its correct functioning ("doing things right") during process execution **= PROCESS IMPLEMENTATION**
- performed, and this represents the direct functioning of the components that interact during process execution ("doing things") **= PROCESS PERFORMANCE**

  and that is also the level where the **variabilities** from process specifications and/or expectations can be 'observed'

  ✓ note that variability can be due to timing, to resources, to external conditions, to residual risks, to lack of monitoring, to inadequate changes, to…: **the HOF 5x5 can be used here**
  = FACTORS OF VARIABILITY



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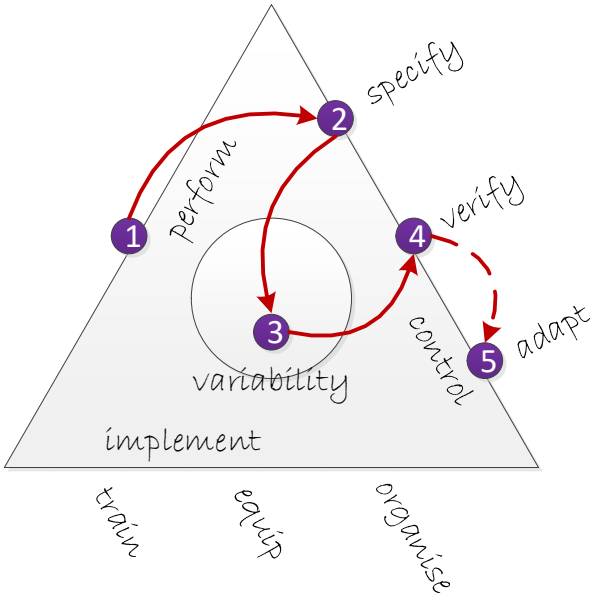
No time to define

A generic set of requirements for the proper functioning of safety related activities at all levels in an organisation are defined clearly

- **Specify**
  The scope and desired outcome of an activity is specified, roles and responsibilities identified, disrupting events are anticipated and risk control measures (rules, barriers) are designed (i.e. work as prescribed/imagined).
- **Implement – train, equip, organise**
  All is done to have activities performed by enough competent people, adequate technical resources are put available and maintained, work products and resources to be used are identified and work is planned in detail.
- **Perform**
  The activity is executed, responding to real life constraints and disturbances (i.e. work as done).
- **Verify**
  The system's performance is monitored, i.e. verifying the match between work as designed and work as actually performed, as well as the elements that could affect this performance in the near term.
- **Adapt**
  It is known what has happened and lessons are learned from experience and the adequate changes to control, or implementation elements, are introduced.

extract from training

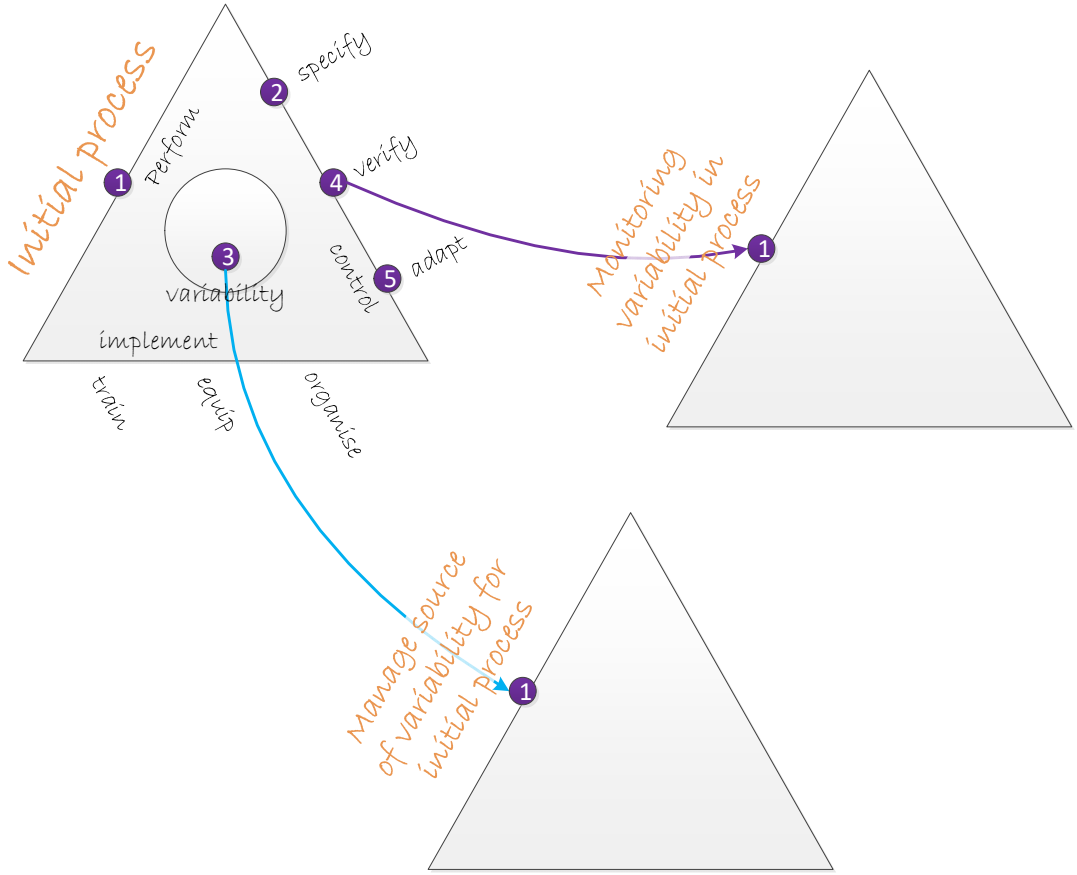
The SMS investigation logic – basic steps

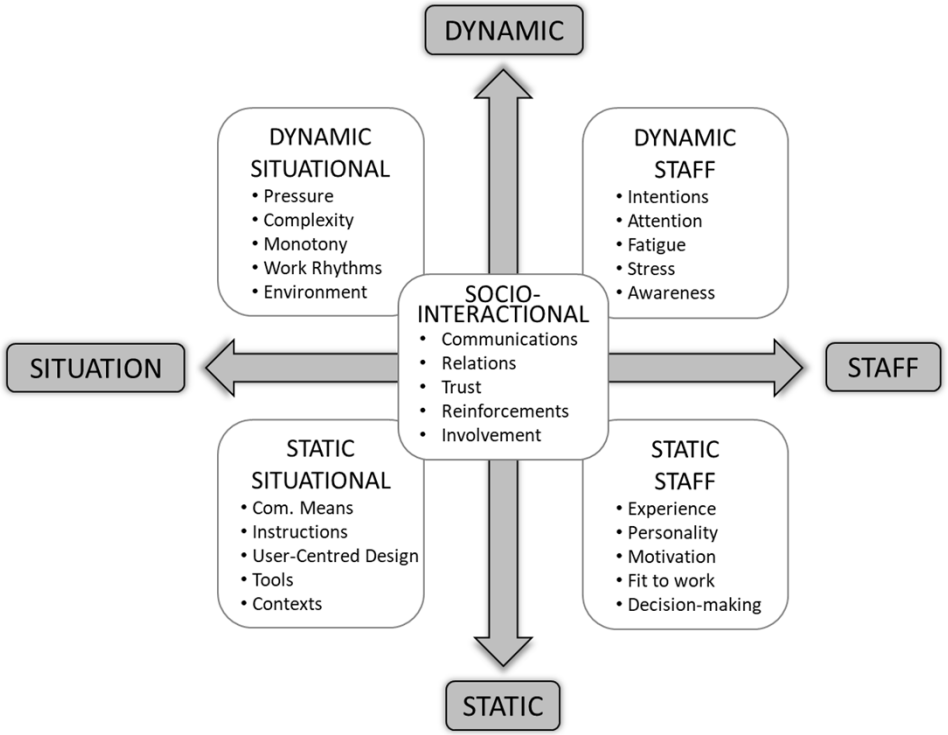


- STEP 1 – **critical performance**: starting close to the event sequence, identify the function or activity that showed critical variability in its performance
- STEP 2 – **expected performance**: for the selected function, identify the expected performance as prescribed and/or specified
- STEP 3 – **source(s) of performance variability**: identify the factor(s) that can explain the critical variability in performance
- STEP 4 – **monitoring of variability**: identify whether the responsible organisation is identifying, monitoring and reporting the critical variability
- STEP 5 – **learning capability** (optional): if reported, identify whether the organisation is learning from the reported (critical) variability

The SMS investigation logic – Going into the SMS

Investigating how the event was made possible in the current SMS





7. Introducing a structured model to investigate the SMS

How analyse the SOURCES OF THE critical variabilities?

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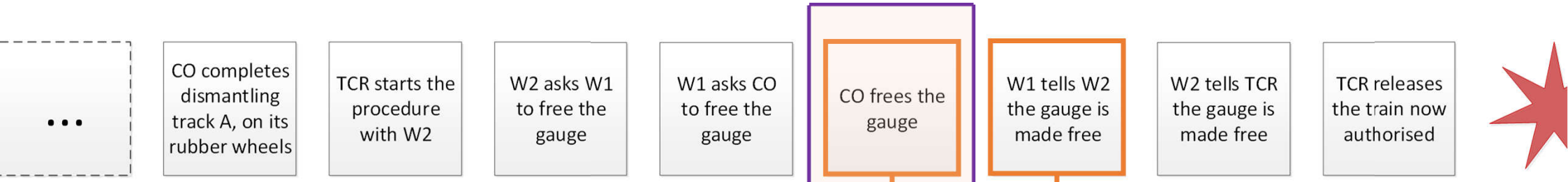
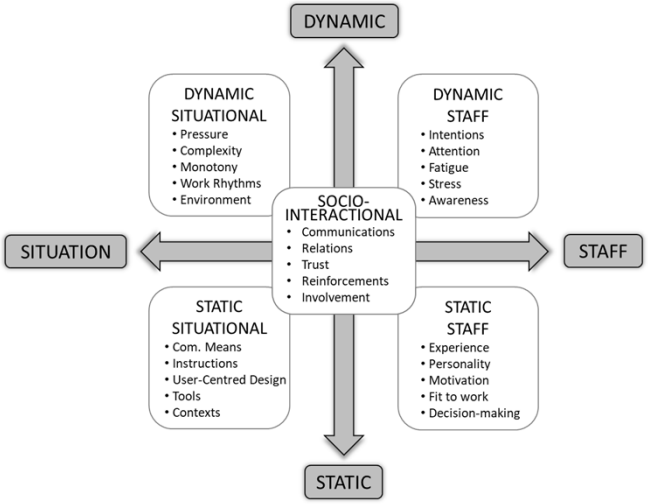


Incorrect distance estimation

Wrong decision



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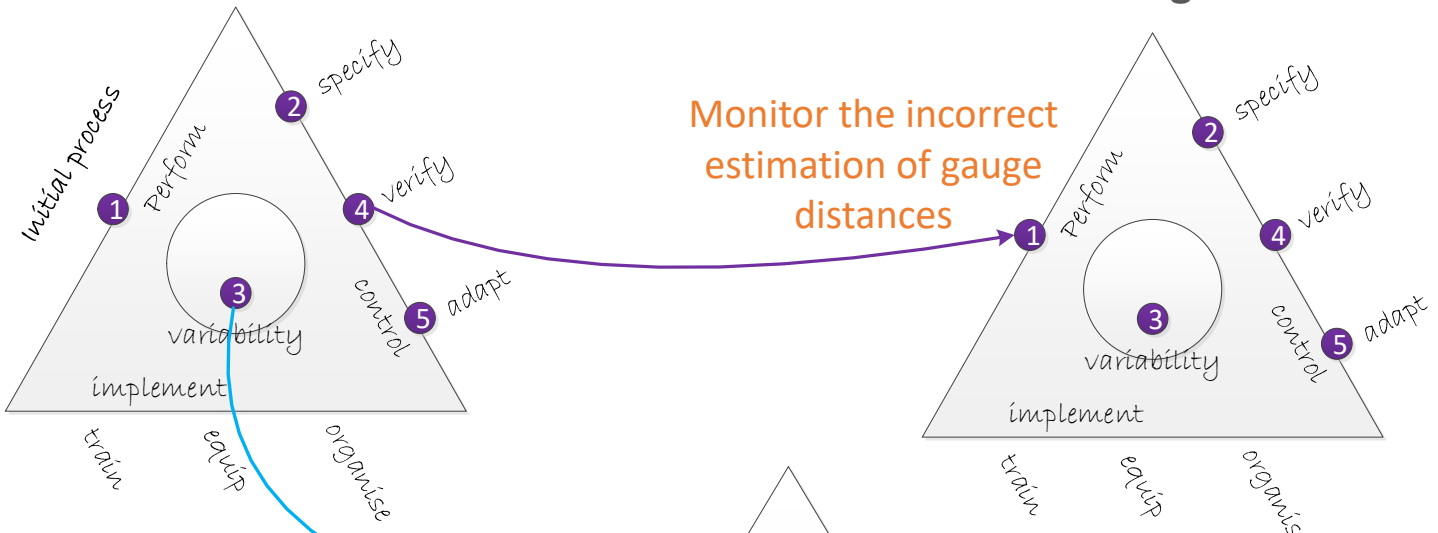
7. Introducing a structured model to investigate the SMS

EXAMPLE

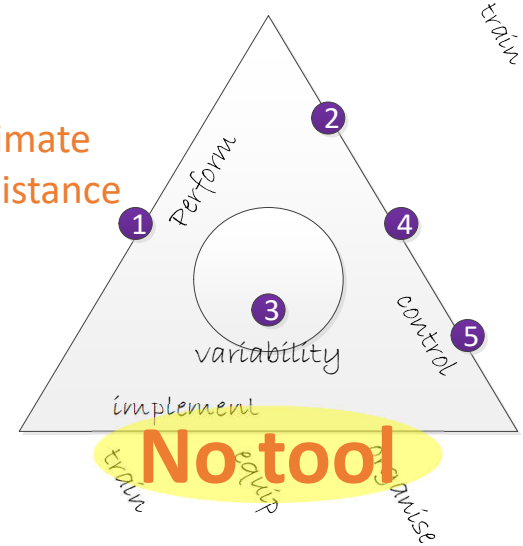
How analyse the SOURCES OF THE critical variabilities and their monitoring?

CO: Incorrect distance estimation



Monitor the incorrect estimation of gauge distances

Estimate the distance



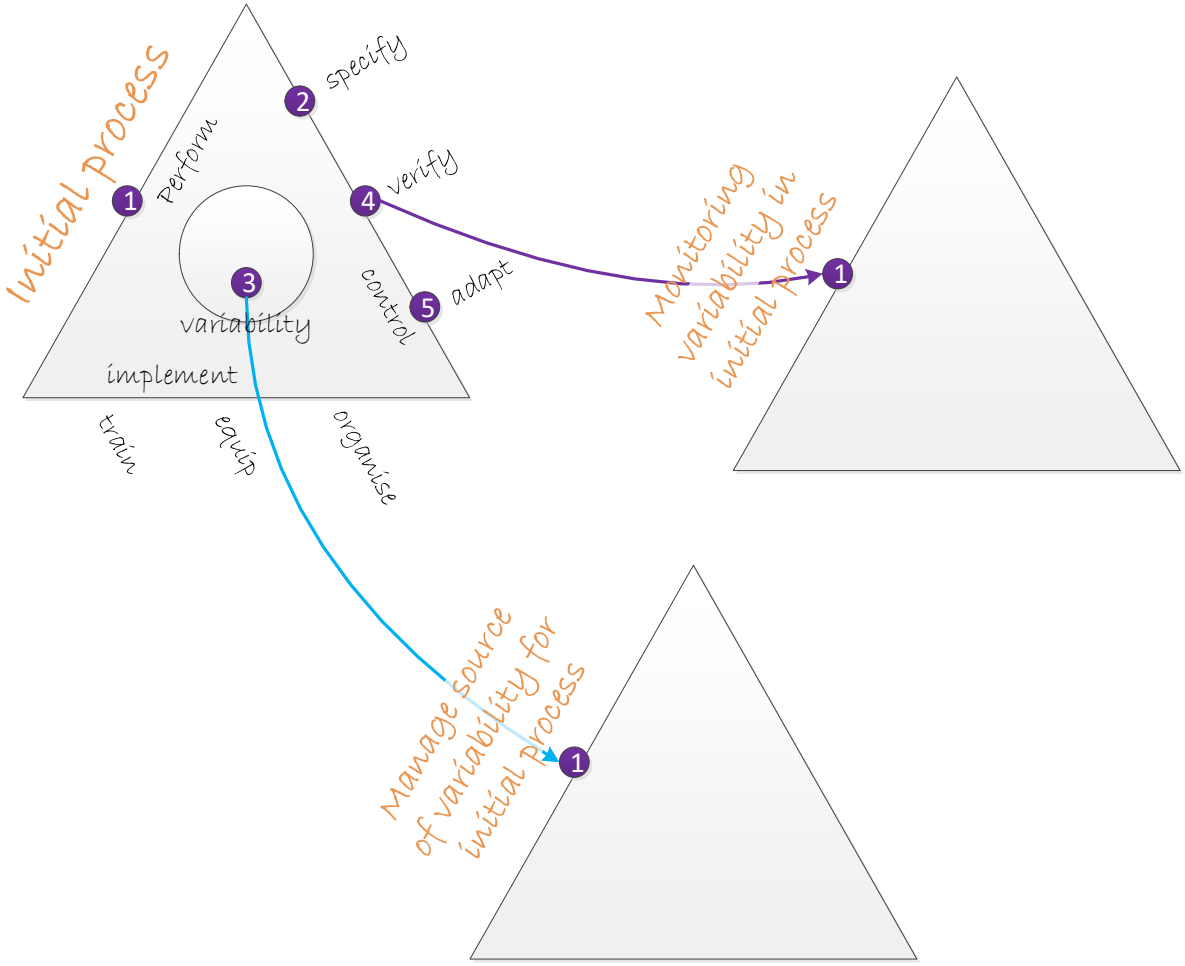
Instructions

Fit to work

Tools

?

7. Introducing a structured model to investigate the SMS



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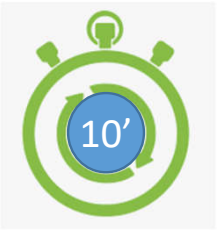
1. Discussion in subgroups

- Subgroups 1-2: analyse the variabilities in the system starting from CO (distance)
- Subgroups 3-4: analyse the variabilities in the system starting from CO (position)
- Subgroups 5-6: analyse the variabilities in the system starting from W1 (decision)

Please prepare first some key questions on the case – I will answer what we received/found in the past

2. Plenary

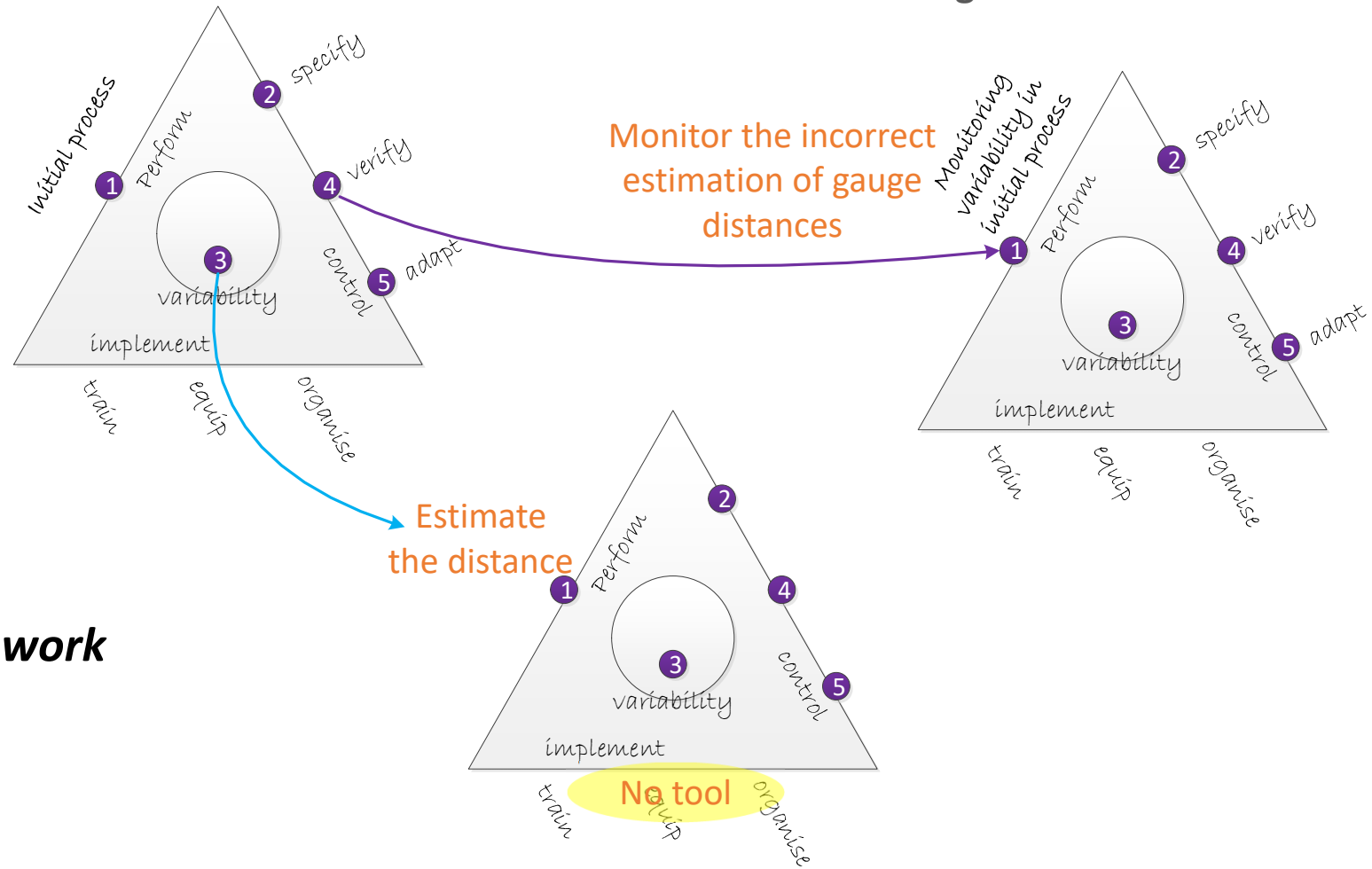
- 6 rapporteurs, post-its, short explanation of the proposals…



Launch of the EXERCISE for GROUPS 1-2

How analyse the SOURCES OF THE critical variabilities and their monitoring?

CO: Incorrect distance estimation



Instructions

Fit to work

Tools

?

Launch of the EXERCISE for GROUPS 3-4

How analyse the SOURCES OF THE critical variabilities and their monitoring?

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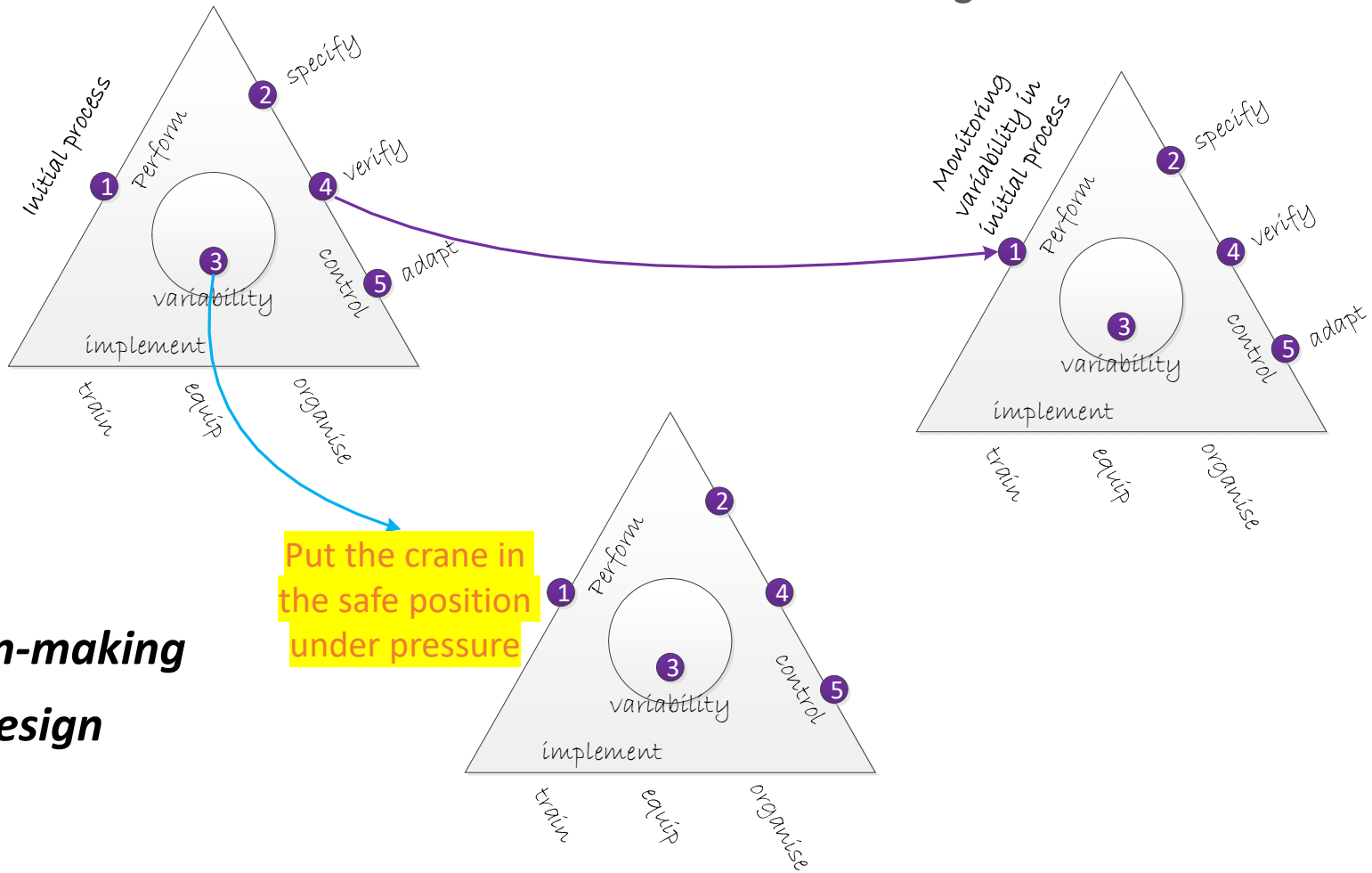


Pressure

Decision-making

User-Centred Design

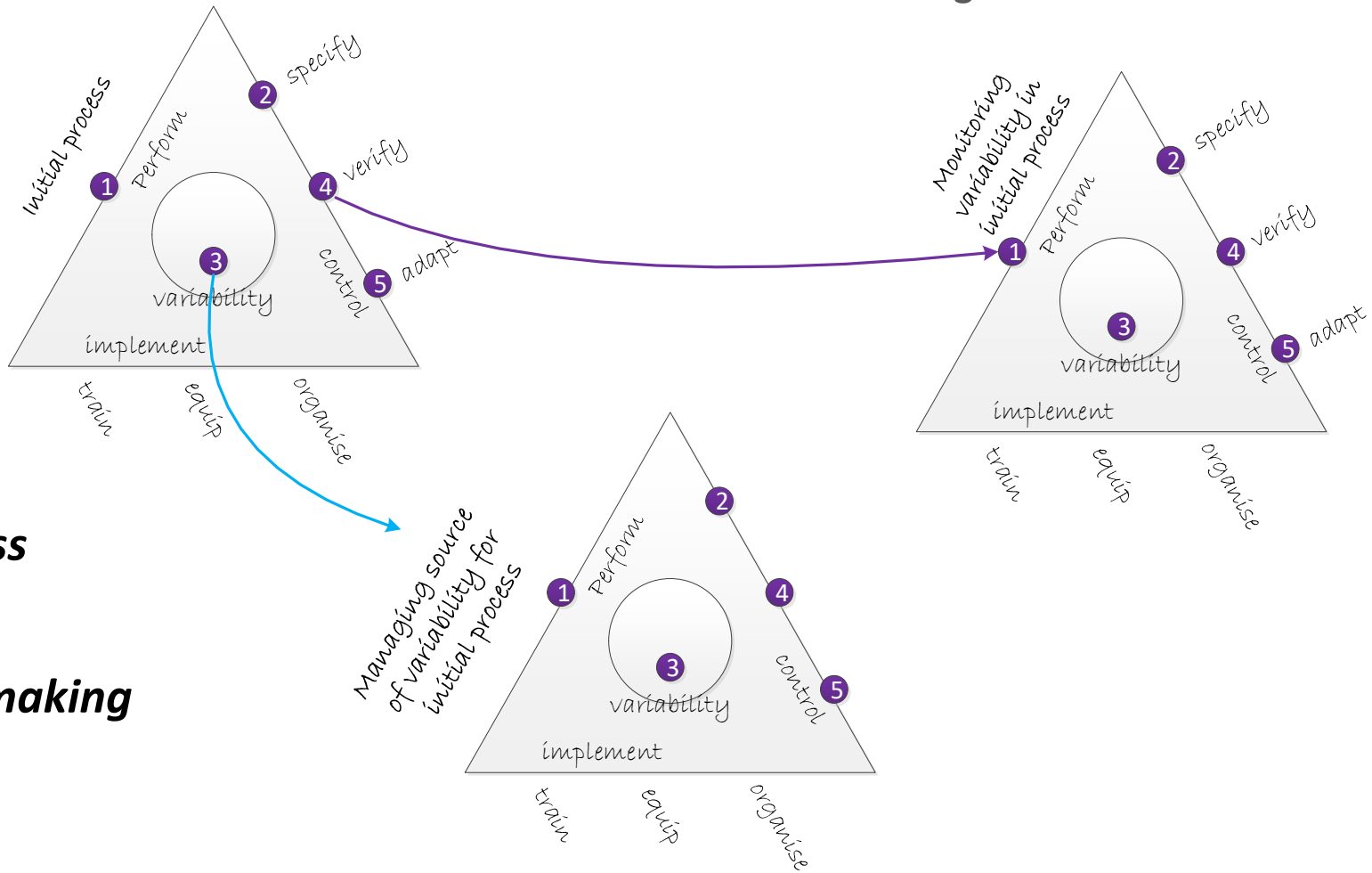
?

7. Introducing a structured model to investigate the SMS

Launch of the EXERCISE for GROUPS 5-6

How analyse the SOURCES OF THE critical variabilities and their monitoring?

W1 makes wrong decision



Monotony

Awareness

Communications

Decision-making

?

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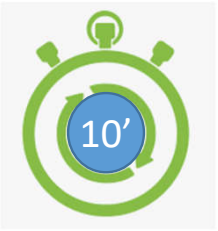
Plenary



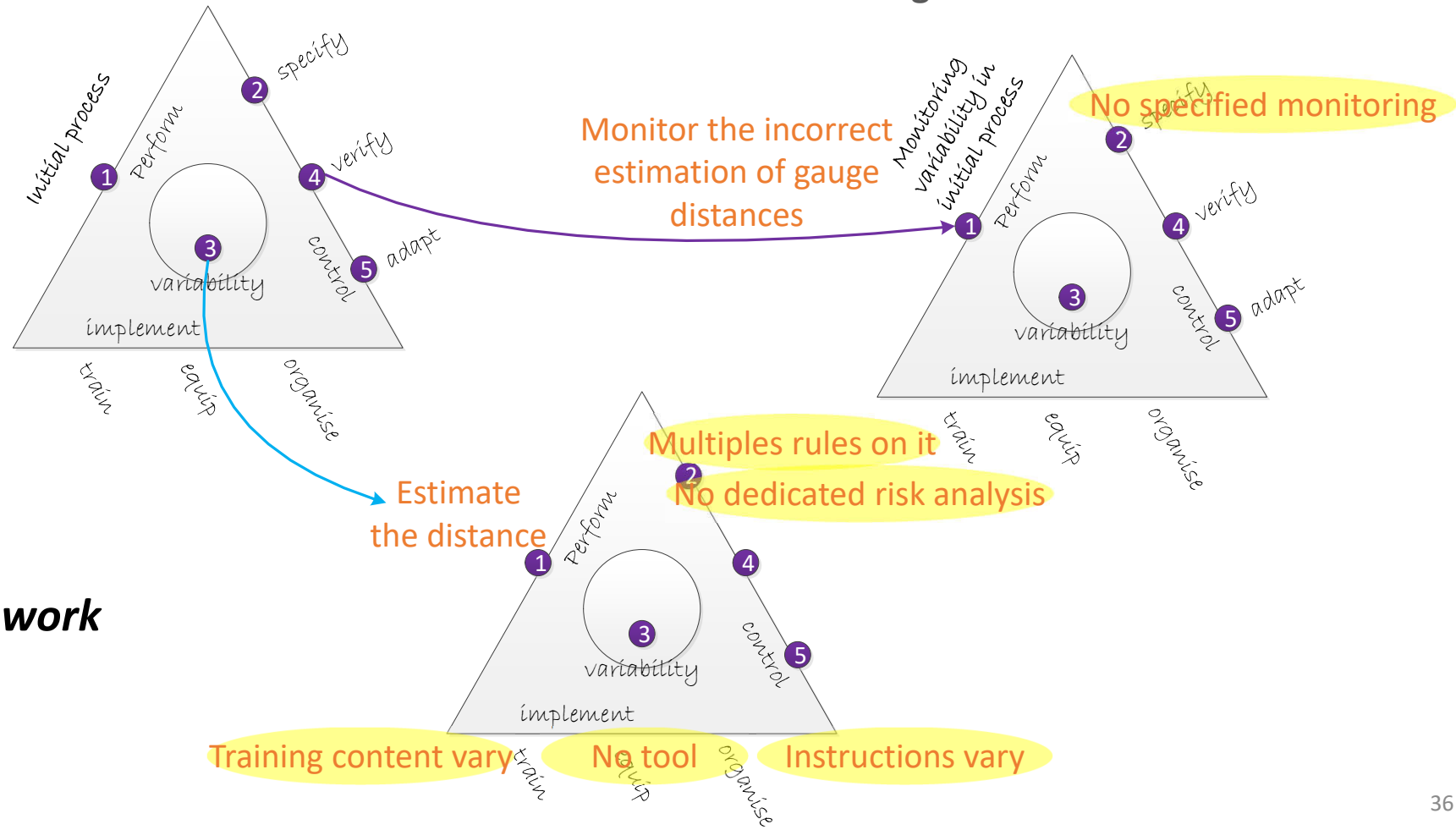
- **6 rapporteurs, post-its, short explanation of the proposals…**

7. Introducing a structured model to investigate the SMS

RESPONSES (groups 1-2)

How analyse the SOURCES OF THE critical variabilities and their monitoring?

CO: Incorrect distance estimation



Instructions

Fit to work

Tools

?

7. Introducing a structured model to investigate the SMS

RESPONSES (groups 3-4)

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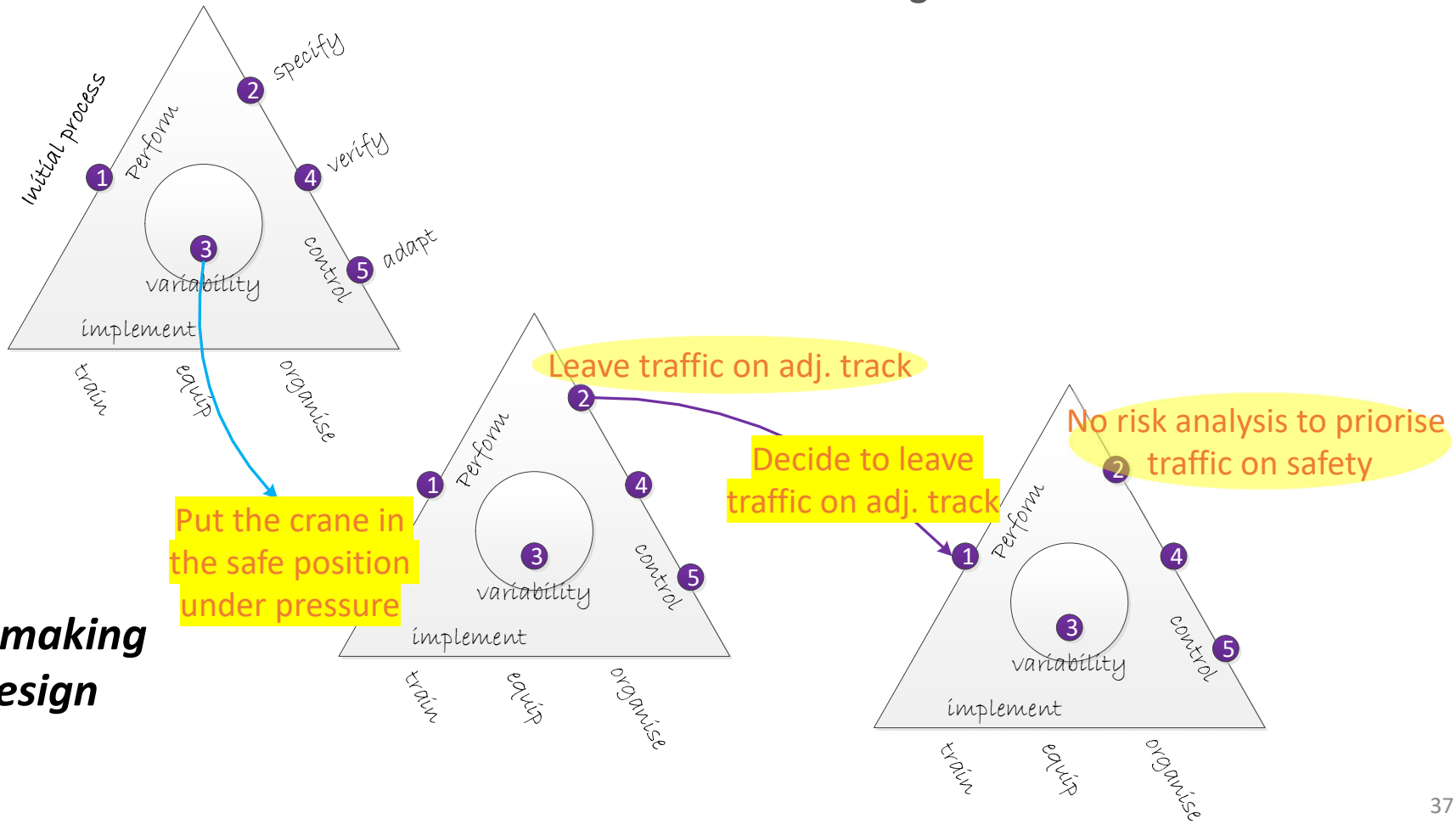


Pressure

Decision-making

User-Centred Design

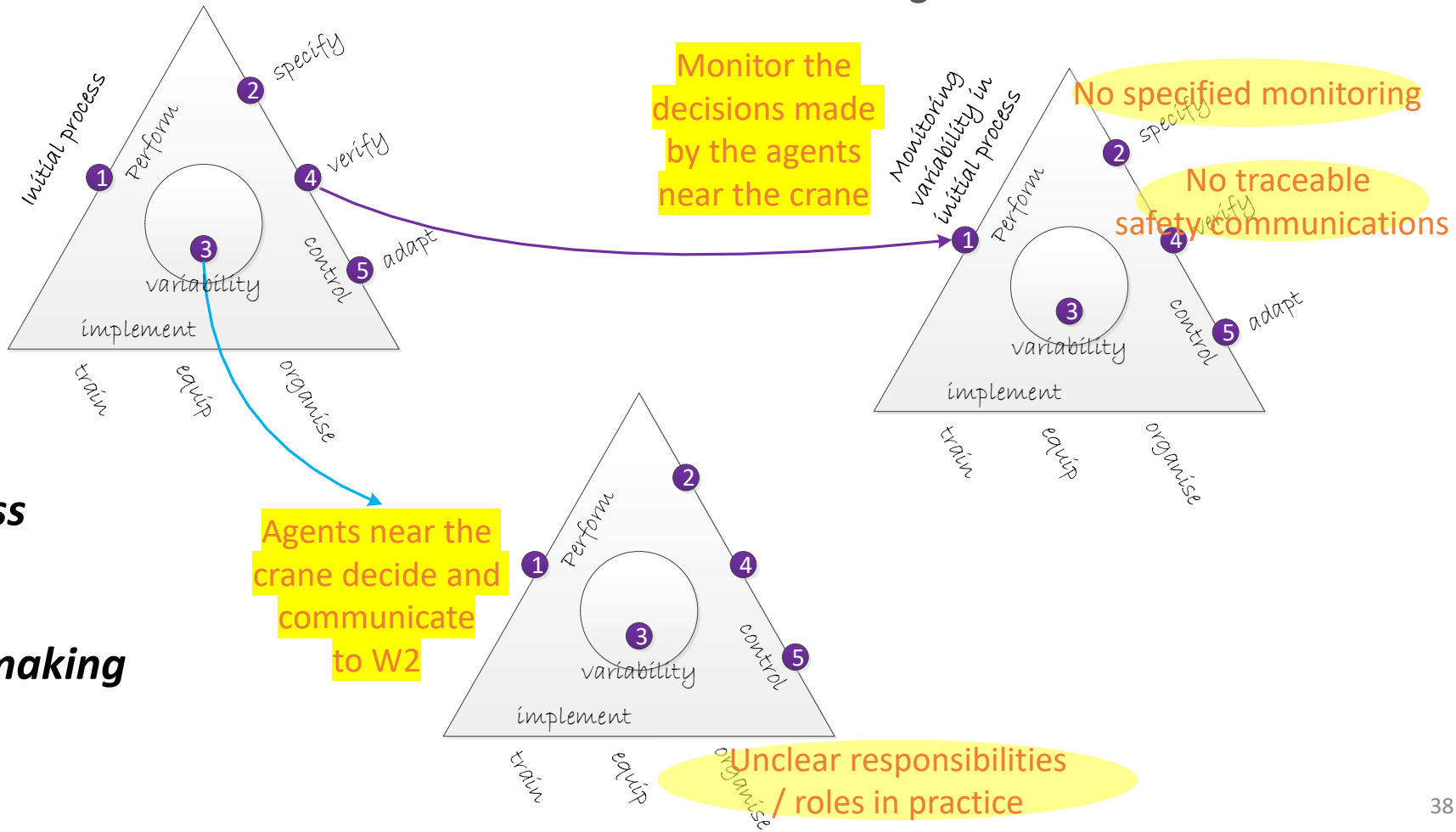
?

7. Introducing a structured model to investigate the SMS

RESPONSES (groups 5-6)

How analyse the SOURCES OF THE critical variabilities and their monitoring?

W1 makes wrong decision



Monotony

Awareness

Communications

Decision-making

?

8. Recommending to develop organisational learning

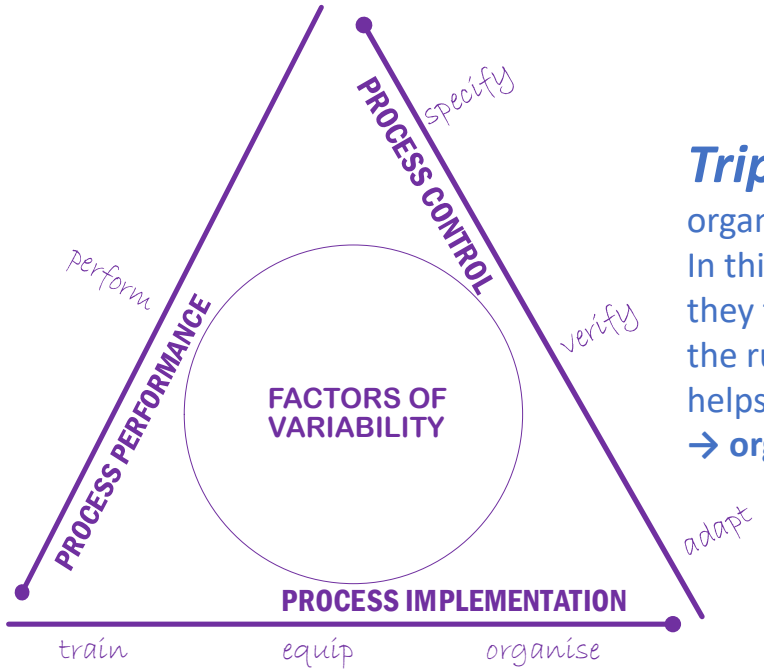
“ Without the SAFRAN/HOF structure, my report would simply have been based on the fact that the agent near the crane gave a gauge free when he was not. I would have treated his preventive suspension quite simply, and the report would have ended quickly without any real analysis.”

- *no technical **means of measuring** the gauge are provided (unless by sight estimation or DIY)*
- ***training material** varies and presents several gauge distances conditional on the environment and the work*
- *multiple and complex **regulatory definition** of the notion of working gauge*
- ***responsibilities and shared roles** of the agents involved are unclear on "deciding": is the gauge free or not?*
- ***neither risk analysis nor prevention specific to compliance** with the gauge are available*
- ***safety communications** between crane operators, agents by cranes, agents in charge are neither verified nor recorded*
- *decision to leave traffic in adjacent track prioritises traffic / **punctuality over safety without any risk analysis***

Levels of recommandations and learning

(After Argyris and Schön, 1996)

Single-loop learning. Rigid strategies, policies and procedures are established and organisations spend their time detecting and correcting deviations from the "rules"
→ following the rules, individual learning.



Triple-loop learning. Members of the organisation reflect on how learning takes place. In this situation, participants would reflect on how they think about the "rules", not only on whether the rules should be changed. This form of learning helps to understand beliefs and perceptions.
→ organise and develop organisational learning

Double-loop learning. Members of the organisation are able to reflect on whether the "rules" themselves should be changed, not only on whether 'deviations' have occurred and how to correct them. This learning often helps participants understand why a particular solution works better than others to solve a problem or achieve a goal.
→ changing the rules, organisational learning

1. Only the **analysis** part of the investigation process
2. The **real case** for this workshop
3. Facing with it: what do **you decide**?
4. The **timeline** and the critical variabilities
5. Introducing a pragmatic model for questioning HOF – **HOF 5x5**
6. What are the **sources of the critical variabilities**?
7. Introducing a structured model to investigate the SMS – **SAFRAN**
8. Recommending to **develop organisational learning**
9. Conclusion & feedback

Investigating an event is not sufficient anymore.
How the event was made possible in the current SMS?

Please, share some feedback

on all of that, the approach based on SMS, HOF 5x5, SAFRAN, trainings…

what did you like?
what can be improved?
what has more / less added value?
(**we have 2 days left!**)

Your feedback is all welcome!

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